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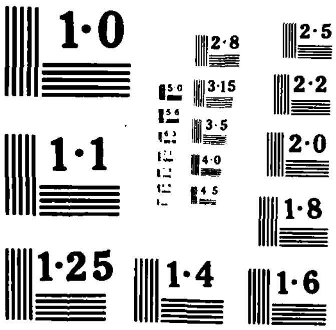
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The study area has experienced land loss and saltwater intrusion due to natural processes such as subsidence and erosion, as well as man's developmental activities including leveeing, channelization, and petroleum exploration. The various natural processes and man's activities have altered overbank flooding and natural distributary flow which historically provided fresh water, sediments, and nutrients to the estuarine areas. This has resulted in conversion of fresh, intermediate, and brackish marshes to more saline marsh types and has

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also caused the loss of substantial areas of wooded swamp. Saltwater intrusion and loss of wetlands have adversely affected the productivity of wildlife and fishery resources. Influx of saline waters is particularly harmful to the American oyster, due to increased predation and disease. Thousands of acres of formerly productive oyster reefs in the area lie largely unproductive due to excessive salinities. One way to ameliorate loss of wetland habitat and rate of saltwater intrusion is timely introduction of fresh water and associated sediments and nutrients into the study area. A total of 13 potential sites were evaluated for diversion of fresh water. Based on the results of this study, it has been recommended that fresh water from the Mississippi River be diverted into Lake Pontchartrain at a site adjacent to the Bonnet Carre' Spillway. This site is located at river mile 128.5. Implementation of this plan would save approximately 4,186 acres of marsh and 6,355 acres of wooded swamp. Additionally, average annual oyster production in the study area would increase by about 7.5 million pounds.

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CULTURAL RESOURCES

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Appendix E

C U L T U R A L R E S O U R C E S

E.0.1. This appendix consists of the cultural resources reconnaissance report. The reconnaissance analysis is of sufficient scope to generally identify the prehistoric and historic resources of the study area and to evaluate the recommended plan in terms of impacts on cultural resources. The analysis also serves as the basis for planning further cultural resources investigations.

Section 1. INTRODUCTION

E.1.1. The study area contains an abundance of cultural resources that range from the prehistoric Archaic Period, 5000-7000 years B.P., to historic times. These resources include prehistoric archeological sites (earth and shell middens, mounds) and historic settlements, buildings, fortifications, and shipwrecks. Many of these resources are recognized as important to our understanding of prehistory and history and are listed in the National Register of Historic Places.

E.1.2. The study area has a diverse and complex history of geomorphological development that has created a dynamic landscape. This ever-changing landscape has shaped human use and occupation of the study area.

E.1.3. The cultural resource analysis concentrated on the Louisiana portion of the study area because of the projected environmental effects of the proposed freshwater diversion. The only effects in the Mississippi portion of the study area would be salinity changes in the Mississippi Sound estuary that would benefit oyster production but not affect cultural resources, and the impacts of the proposed construction of two small, 2-acre recreation sites in the Bay St. Louis area.

Section 2. METHODOLOGY

E.2.1. The analysis conducted for this report was a cultural resources reconnaissance. The analysis combined review of background data with limited field examination of the study area. Background data were used to aid the planning effort, assess plan impacts, and guide the cultural resources survey that will be conducted during the next stage of planning. These data included:

- Information provided by the Louisiana State Historic Preservation Officer regarding recorded archeological sites, National Register properties, and pending nominations in the study area,

- Historic Mississippi River Commission maps dated 1876 and 1921, on file at the New Orleans District,

- John La Tourette's "Reference Map of the State of Louisiana" dated 1853,

- USGS quadrangle maps of the study area dating to the 1890's, on file at the New Orleans District,

- Aerial photographs (1:10,000 scale) of the study area taken 1930-33, on file at the New Orleans District,

- Aerial infra-red photographs (1:24,000 scale) taken 1978, on file at the New Orleans District,

- Previous Corps-sponsored cultural resources survey coverage in the study area.

E.2.2. The purpose of the review was to identify locations of recorded cultural resources and "high probability areas" within the potential impact area of the project. The field examination was conducted during 1982 and 1983 and involved a general visual inspection of the Bonnet Carre' diversion site. No subsurface testing or detailed architectural evaluations of structures in the rights-of-way were performed.

Section 3. SIGNIFICANT RESOURCE CATEGORIES

E.3.1. Based on information in other sections of this report and guidelines in the US Army Corps of Engineers regulation, "Environmental Quality: Policy and Procedures for Implementing NEPA," three significant cultural resources categories were identified in the study area. The three categories are National Register properties, National Trust properties, and archeological resources.

NATIONAL REGISTER PROPERTIES

E.3.2. Historic properties listed in or determined eligible for the National Register of Historic Places are significant resources by virtue of their National Register status. The National Register of Historic Places was established as the key tool for cultural resource management when the National Historic Preservation Act was enacted in 1966. This law and various other Federal mandates require that all Federal agencies having direct or indirect jurisdiction over Federal or Federally-assisted and licensed activities "*take into account*" *the effects* of the proposed undertaking on significant cultural resources. A significant cultural resource is defined by these Federal mandates and the resulting Federal regulations as one that meets the criteria for inclusion in the National Register of Historic Places *contained in* Title 36, Code of Federal Regulations, part 60.4.

NATIONAL TRUST PROPERTIES

E.3.3. Historic properties of the National Trust for Historic Preservation are considered significant resources because this private organization has identified them as important resources worthy of preservation.

ARCHEOLOGICAL RESOURCES

E.3.4. The archeological resources category was included as a significant resource in order to take into account the archeological resource base in the study area. The inclusion was necessary because the National Register category is site-specific and the cultural resources survey coverage in the study area is limited.

E.3.5. The destruction and loss of the archeological resource base in the nation has long been a concern of the public and the archeological profession. Federal mandates of past decades have established a national policy of enhancement and preservation of cultural resources. Therefore, it is appropriate to consider the known and projected archeological resource base of the study area as a significant resource.

E.3.6. In the project-affected area, the recommended plan has not been subjected to an intensive cultural resources survey. Therefore, to restrict consideration of archeological resources to those presently included in the National Register would not adequately address the impacts of the plan upon cultural resources. Including the archeological resources category permits impacts on the resource base to be assessed in general rather than assessing only impacts on the few presently identified National Register and Register-eligible properties.

Section 6. IMPACT ASSESSMENT

GENERAL

E.6.1. Assessing impacts on cultural resources is limited by the lack of cultural resources surveys to identify all the resources in the potential impact area. A full assessment of project impacts cannot be accomplished until the cultural resources survey of the recommended plan is completed during the preconstruction planning and engineering studies.

E.6.2. Possible adverse effects on cultural resources would include direct impacts from construction of the diversion structure, associated channels and levees, and the proposed recreation sites. The beneficial effect of the proposed plan would be preservation of cultural resources located in the marsh projected to be "saved" through the project life.

BONNET CARRE' DIVERSION SITE

E.6.3. No recorded archeological sites or National Register or Register-eligible properties are located in or near the proposed rights-of-way of the diversion site. The portion of the rights-of-way between the Mississippi River levee and the river was covered by the cultural resources survey of the proposed LaPlace-Destrehan Levee Enlargement (Mile 133.1 to 121.1, left descending bank) conducted in 1983 by the National Park Service under contract to the US Army Corps of Engineers, New Orleans District. The survey located no culcural resources in the area and cited extensive ground disturbance and recent alluviation as a possible explanation for the negative findings.

E.6.4. Field examination, review of available historic documentation, and geomorphological details of maps and aerial photographs suggest the

E.5.12. Under future without-project conditions, the archeological resources of the study area will continue to be adversely affected by natural and human-induced processes. The natural destruction of the alluvially deposited land forms of the area has been accelerated by human actions such as canal construction and leveeing that prevent freshwater and sediment introduction. The processes have destroyed and inundated much of the resource base. Urban expansion into the low-lying swamps and marshlands has also resulted in loss of the resource.

ARCHEOLOGICAL RESOURCES

E.5.8. Over 290 archeological sites are recorded in the Louisiana portion of the study area. These sites include both prehistoric and historic cultural remains. The most common type of prehistoric sites are earth and shell middens although mound sites are also represented. Middens are concentrations of various kinds of refuse built up over a period of years. They represent the garbage of the prehistoric occupants of the site. Predominant components of the middens are the shells of two species of shellfish, oyster and *Rangia cuneata*. Extensive investigations have shown that some middens represent habitation sites while others were special collection stations. Midden sites are spread over the entire study area.

E.5.9. Historic archeological resources include early settlements, forts, historic shipwrecks, structures, and other remains of historic use. These resources date from the earliest exploration and settlement of the Lower Mississippi River and represent the successive stages in the area's history.

E.5.10. In addition to these resources, over 330 archeological sites are recorded in counties in the Mississippi and Alabama portions of the study area (Mobile District, Corps of Engineers 1982). In the Mississippi Sound area, 159 shipwrecks that occurred between 1643 and 1945 are recorded.

E.5.11. No recorded archeological sites are located in the proposed rights-of-way of the Bonnet Carre' diversion site or the six proposed recreation sites. The number of known archeological site locations is largely a function of where cultural resources surveys have been undertaken. Therefore, the recorded resource base is an incomplete sample of the resources expected to exist in the study area.

is a large, well-preserved, multi-component archeological site that possibly served as a major ceremonial center in the delta.

E.5.3. In addition to these resources, a number of National Register properties are listed in the three Mississippi counties and the one Alabama county included in the study area. These include 41 properties listed or determined eligible in the Alabama county and 25 such properties in the three Mississippi counties (Mobile District, Corps of Engineers 1982).

E.5.4. No National Register properties are located in or near the proposed rights-of-way of the Bonnet Carre' diversion site or the six proposed recreation sites. The cultural resources survey of the tentatively selected plan, which will be conducted in the next stage of project planning, may locate additional cultural resources eligible for inclusion in the National Register.

E.5.6. Under future without-project conditions, the eight National Register properties located in the project-affected area will continue to be adversely affected by the natural and human-induced processes of erosion, wavewash, and subsidence as well as by urban and industrial expansion into presently undeveloped low-lying areas. These impacts are significant and deleterious to the resources of the area.

NATIONAL TRUST PROPERTIES

E.5.7. The only National Trust property in Louisiana is Shadows-on-the-Teche on Bayou Teche in Iberia Parish, west of the study area. This property is outside the study area and, therefore, will not be affected by the proposed project.

NATIONAL REGISTER PROPERTIES

E.5.1. The National Register of Historic Places, as published in the Federal Register dated 6 February 1979 and in annual and weekly supplements through 17 May 1983, was used to identify National Register and Register-eligible properties in the study area. Within the Louisiana portion of the study area, eighteen properties have been listed in the Register. Of these, eight are located on the Mississippi River natural levee and will not be affected by the proposed project.

E.5.2. Eleven National Register properties are located in the project-affected area. These include Forts Pike and McComb, massive brick fortifications built in the early 1800's to protect the two natural passes into Lake Pontchartrain, the Rigolets and Chef Menteur Pass. Three lakefront structures in the historic town of Mandeville on the north shore of Lake Pontchartrain are listed in the Register. Also located in the study area are the Tchefuncte and Pass Manchac Lighthouses which are in the process of being nominated to the National Register of Historic Places by the US Coast Guard. Two archeological sites located in the marshes and swamps that constitute the lake shoreline are also listed in the Register. One is the Tchefuncte site (16ST1) composed of two Rangia shell middens in the marsh east of Mandeville. The other, the Bayou Jasmine site (16SJB2), is a deeply buried cultural deposit dating to the Poverty Point period that is located in St. John the Baptist Parish between Lakes Maurepas and Pontchartrain. Two of the properties are in the St. Bernard delta, Fort Proctor and Magnolia Mound (16SB49). Fort Proctor was begun in 1856 to protect a possible invasion route to New Orleans from Proctor's Landing on Lake Borgne. From this landing, Bayou Yscloskey and a parallel shell road provided access to the Mississippi River. Magnolia Mound (16SB49)

E.4.23. The passes and bayous in the vicinity of New Orleans provided easy access to the new capital but also made the settlement vulnerable to attack. As a result, many fortifications were built in strategic locations. The historic importance of Lake Pontchartrain is clearly evident from the location of Fort St. John at the mouth of Bayou St. John, Fort Macomb at Chef Menteur Pass, and Fort Pike at the Rigolets. The route of the British invasion forces defeated at the Battle of New Orleans in January 1815 conclusively demonstrated the vulnerability the area. The British came from the Gulf of Mexico through Lake Borgne and up Bayous Bienvenue and Maxent to the natural levee of the Mississippi River at Chalmette. To defend the Lake Borgne passes against future invasion, three fortications were built on the shores of Lake Borgne: Proctor's Tower, Tower Dupre, and Battery Bievenue.

HISTORY OF THE STUDY AREA

E.4.21. The historic significance of the study area is primarily due to its strategic location near the mouth of the Mississippi River. Control of this area was the key to controlling the vast Mississippi River Basin. European exploration of the lower Mississippi River began in 1682 with LaSalle's second expedition. In 1699, French colonists led by Iberville began their settlements at Ship Island and Biloxi. Further exploration of the river quickly followed and in 1700 the first permanent structure in the Lower Mississippi Valley, Fort de la Boulaye, was constructed near present-day Pointe a la Hache by French colonists led by Bienville.

E.4.22. Since control of the river was the main goal of colonization, it was essential to establish a settlement on the river. Under Iberville, New Orleans was founded in 1718 and soon became the capital of French Louisiana. The navigable connection between the Gulf of Mexico and New Orleans via Lake Pontchartrain was a significant factor in the siting, early settlement, and economic development of the city. French explorers first used this route via Bayou St. John in 1699 and its commercial importance continued into the 20th century. Initial settlement of the new site was concentrated along Bayou St. John and on the relatively high natural levees of the river and its distributaries. Historic settlement in the study area continued from the French colonial period to the present but occurred primarily on the elevated, natural levee ridges and active and relict beach ridges. Most of the land in the study area is swamp and marsh characterized by flooding and constant land loss and was not suitable or attractive for permanent settlement. Because of the biological productivity of these areas, they became the focus of hunting and fishing activities.

increase in the late Marksville (1750 to 1550 years B.P.) period. CEI cites possible migration into the delta as an explanation for this population growth. The Magnolia Mound site (16SB49) was possibly the center of late Marksville settlement throughout the delta. This site is on a major distributary levee and was centrally located near all zones of marsh.

E.4.18. The observed increase in human settlement in the St. Bernard delta during Marksville times can be well explained by the CEI model of settlement based on the delta cycle. Initial population growth (early Marksville) occurred during the mature delta progradation and intensified after the delta was abandoned (1700 years B.P.) and transgressive deterioration began (late Marksville).

E.4.19. Prehistoric habitation in the Pontchartrain Basin is evident again in the Troyville Period (1550 to 1250 years B.P.). The Coles Creek (1250 to 950 years B.P.) and Mississippian (1850 to 250 years B.P.) cultural periods are also well represented throughout the study area.

E.4.20. In the study area and throughout coastal Louisiana, the settlement and subsistence patterns of the post-horticultural period (Marksville through Mississippian) are not well known. Archeological data do, however, conclusively show a continued heavy dependence on hunting, gathering, and fishing throughout the prehistoric period. It is generally assumed that horticulture played only a minor role in the subsistence strategy on the coastal plain.

E.4.14. CEI (1979) uses the chiefdom/redistribution model for the Poverty Point period to postulate that the Claiborne site served as a regional center for the study area. Other sites of this period are viewed as linked to this center and possibly only used seasonally.

E.4.15. The Tchefuncte period (2500 to 2000 years B.P.) witnessed a dense occupation of the Pontchartrain Basin. In fact, the Tchefuncte culture of the Lower Mississippi Valley archeological sequence was first defined by Ford and Quimby (1945) in their synthesis of archeological data from the Pontchartrain Basin. The sites Ford and Quimby studied included sites 16OR1 to 16OR5, Big Oak (16OR6), Little Oak (16OR7), and the Tchefuncte site (16ST1). The period is also represented in the St. Bernard delta. Shenkel's (1974) work indicates that there were apparently two types of Tchefuncte sites, shellfish procurement stations and village sites. The excavations also show a decline in the use of Rangia in the early Marksville period. The decline is probably related to the freshening of Lake Pontchartrain that Roger Saucier hypothesizes occurred when the Bayou Sauvage lobe of the St. Bernard delta closed off the lake. Saucier presented his hypothesis in a 1963 report on the geomorphic history of the Pontchartrain Basin.

E.4.16. As stated previously, NWR postulates that the freshening of Lake Pontchartrain, which Saucier identifies as in the early Marksville period (2050 B.C. to 1750 years B.P.), possibly caused a migration out of the Pontchartrain Basin and into the emerging St. Bernard delta. This scenario is supported by site locational data in the study area. Only limited, small Marksville occupations are found in the Pontchartrain Basin. Compared to the earlier Tchefuncte occupations, site density is very low (NWR, 1983).

E.4.17. However, in the St. Bernard delta, CEI notes an increase in site density during the early Marksville period with an even greater

HUMAN HABITATION AND BIOLOGICAL PRODUCTIVITY AS A FUNCTION OF THE DELTA CYCLE

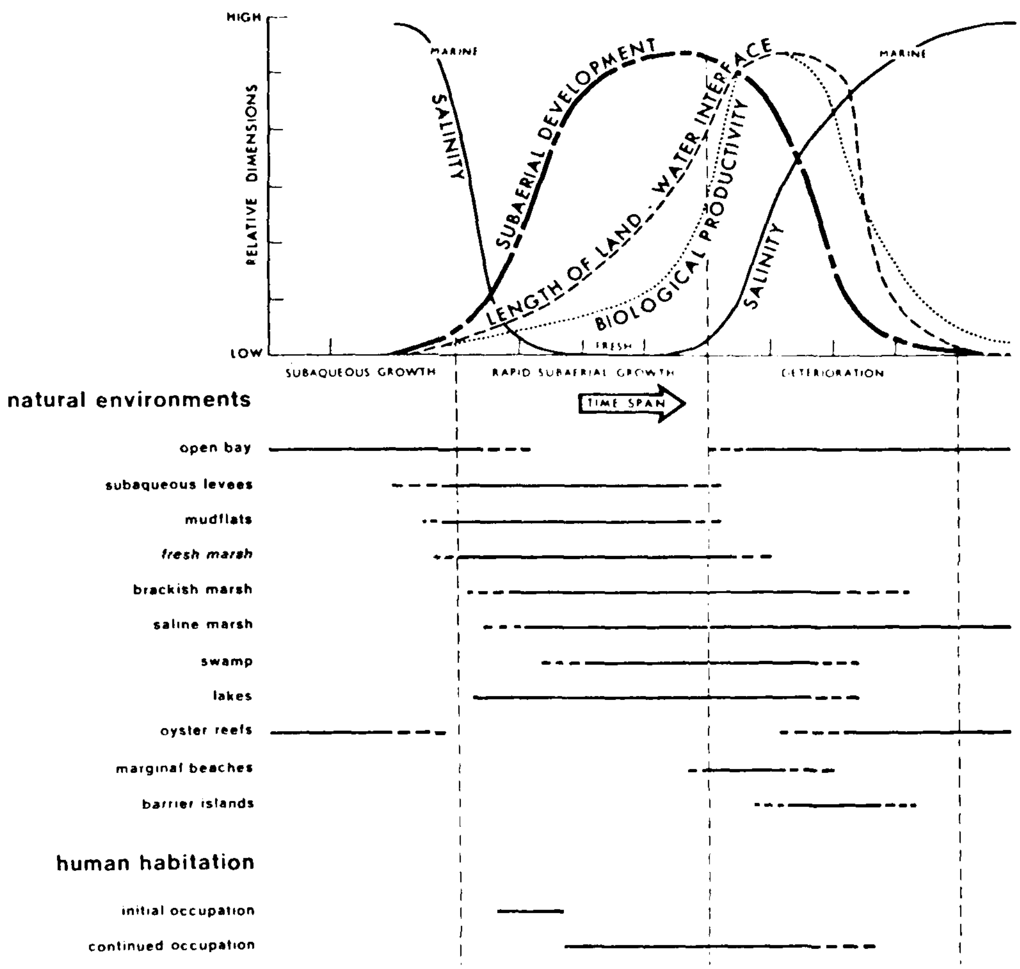

Fig. 1. Environmental succession of an idealized delta cycle. The time required for completion of a cycle varies from decades to thousands of years, depending on the size and complexity of the lobe. Associated with the cyclic character of delta building is a sequence of environmental changes. These changes in turn influence the character of human utilization and exploitation (After Gagliano and van Beek 1975).

E.4.11. Coastal Environments, Inc., (CEI) offers a different explanation for site distributional changes in the study area, especially in the St. Bernard delta (1979). CEI postulates that as the Mississippi River abandoned the St. Bernard delta and landforms declined, human settlement in the delta flourished. This assumption supports their theory of human habitation as a function of the delta cycle, as illustrated by figure 1. The location of initial site occupation in the St. Bernard delta suggests occupation in areas entering the deterioration phase. CEI states that this is the result of several favorable environmental variables: natural levees are sufficiently elevated, flood danger is reduced, biological productivity is at a maximum, and there is a great diversity of habitats. These hypotheses are tentative since no archeological sites in the St. Bernard delta have been systematically excavated.

PREHISTORY OF THE STUDY AREA

E.4.12. The earliest reported occupations in the area date to the pre-Poverty Point Late Archaic period. Archeological sites of this period are small shell middens and are located in the lower Pearl River area. These sites are apparently related to relict shorelines, show a heavy reliance on oysters, and have been radiocarbon dated to 3515 B.C. (Gagliano and Saucier, 1963).

E.4.13. The Poverty Point period (3500 to 2500 years B.P.) is well represented in the area. Sites of this period include the Bayou Jasmine site (16SJB2), the Linsley site (16OR40), the Garcia site (16OR34), and the Claiborne site (22HA501). The Bayou Jasmine and Linsley sites, deeply buried deposits associated with natural levee ridges, were discovered only through highway and canal construction. Data from the sites indicate that these occupations focused on exploitation of Rangia, fish, and small mammals.

patterns change through the various phases of prehistoric culture, undoubtedly in response to the dynamic nature of this environment. New World Research, Inc., (NWR) in a recent (1983) report on a cultural resources survey of the Lake Pontchartrain and Vicinity Hurricane Protection project, postulated that one ecological factor overrides all others in the shifts of prehistoric settlement. That factor is the movement of the brackish water clam, *Rangia cuneata*. They note that regardless of cultural content or affiliation, economic focus on this resource remained constant. They concluded, therefore, that shifts in settlement patterns over time appear to closely correspond to the movement of the brackish marshes that are *Rangia* habitat.

E.4.9. According to this theory, the key to understanding prehistoric settlement shifts in the area is study of the geomorphological processes to determine salinity variations through time. The zone of brackish marsh in an estuary advances seaward during delta growth as fresh water is introduced and emerging landforms block saltwater intrusion. The brackish marshes retreat inland when the delta is abandoned and subsides and saltwater intrusion advances. NWR theorizes that prehistoric inhabitants responded directly to these shifts in the location of brackish marsh.

E.4.10. NWR argues that information available on the Lake Pontchartrain Basin supports this hypothesis. Noting that there is an apparent sparcity of Marksville Period sites in the basin, NWR argues that at approximately 2050 years B.P. the inhabitants may have followed the brackish marshes southward into the expanding St. Bernard delta. As this delta complex was abandoned, brackish habitat retreated back into the Pontchartrain Basin and prehistoric groups returned, possibly during the Troyville Period when archeological sites again appear in abundance. This hypothesis is supported by the large increase in site density in the St. Bernard delta during the late Marksville period (Coastal Environments, Inc. 1979).

area. The earlier Cocodrie complex (4500 to 3600 years B.P.) created Lake Pontchartrain through deposition in the western portion of the Pontchartrain Basin and burial of the beach island trend along the southeastern shore. The St. Bernard complex (2800 to 1700 years B.P.) continued deposition along the lake's southeastern shore and created the massive St. Bernard delta.

E.4.5. Except for the Pearl River deposition, major land building processes have stopped. Subsidence, erosion, and saltwater intrusion have become dominant forces in a destructive phase of delta development.

IMPLICATIONS FOR PREHISTORIC HABITATION

E.4.6. The geomorphological processes are important to archeology because they created the extremely productive estuarine environments. These environments provided an abundance of resources that required little complex technology or effort for subsistence. The marshlands and shallow waters of the estuaries supported diverse and abundant fauna and flora. The archeological record documents that prehistoric inhabitants used sluggish water lowland fish and shellfish, small mammals, reptiles, and fowl.

E.4.7. Because of the biological productivity, prehistoric peoples settled in the study area. The archeological record indicates that settlements occurred primarily on the natural levees of the delta complex distributaries and surviving beach ridges. These land forms gave access to the estuarine resources while providing some measure of flood protection. It is these geomorphic features, then, that are of primary archeological interest.

E.4.8. Several theories have been advanced to explain observed prehistoric settlement patterns in the area. Settlement distribution

Section 4. PREHISTORIC AND HISTORIC OVERVIEW

E.4.1. The study area comprises several geographic zones of archeological interest including the Lake Pontchartrain Basin, the lower Pearl River Basin, and the St. Bernard delta complex. Recent studies commissioned by the US Army Corps of Engineers, New Orleans District, shed light on the archeological record of the study area. These investigations emphasize that an understanding of geomorphic processes and environmental reconstruction is essential in order to adequately interpret settlement patterns and determine high probability areas.

GEOMORPHOLOGY

E.4.2. The landforms of the study area and, therefore, the nature of the aquatic environment are of Recent (Holocene) origin. They are the result of alluvial processes of the Mississippi and Pearl Rivers and the smaller streams that empty into Lake Pontchartrain. Change is an ever-present factor in this estuarine environment, a fact that confronted the prehistoric and historic inhabitants of the area and that confronts people today.

E.4.3. While the exact sequence and timing of the geomorphological processes are not presently resolved, important details are well accepted. The study area began as a portion of the continental shelf following the end of the Pleistocene. The landforms are the result of alluvial deposition in the Holocene period, primarily of the Mississippi River. The Pontchartrain Basin was begun by formation of the Pine Island Beach trend approximately 4,500 years B.P. that created a protected embayment of the gulf.

E.4.4. Two of the Mississippi River's seven Holocene deltas, the Cocodrie and St. Bernard complexes, are of significance to the study

possibility of affecting cultural resources. None of the standing structures in the proposed rights-of-way are currently listed in the National Register nor do they appear eligible for inclusion. Most of the structures are of relatively recent construction although a few adjacent to the levee are probably more than 50 years old. Full assessment of these structures, including completion of Louisiana Standing Structure Forms, will be accomplished during the cultural resources survey.

E.6.5. The potential impacts on cultural resources include the possibility of affecting buried historic remains in the diversion structure area outside of the spillway and deeply buried archeological deposits in the channel rights-of-way. Review of the 1875 Mississippi River Commission (MRC) map shows New Hope Plantation, owned by Adam Keller, in the diversion structure area and indicates numerous standing structures. The 1921 MRC map shows numerous small structures located linearly along the levee with no indication of the New Hope Plantation. A possible interpretation is that New Hope Plantation was divided into many small land holdings and thus ceased to exist.

E.6.6. Aerial photographs from 1934 show the diversion structure area soon after construction of the Bonnet Carre' Spillway. Construction of the spillway, levees, and roads obviously affected a portion of the area. However, the majority of the area of the proposed freshwater diversion structure was largely undisturbed.

E.6.7. The Mississippi River levee fronting the project rights-of-way has been located in the same position at least since 1924 and possibly much earlier. Because of the location of the levee on a building bank of the river, no recent levee setbacks have been necessary. This fact increases the possibility of buried *in situ* remains in the proposed diversion structure area.

E.6.8. From this information, it appears possible that construction of the diversion structure may affect archeological deposits associated with human use and occupation of the area. This possibility is much reduced for the portion of the rights-of-way within the spillway for several reasons: the area is away from the Mississippi's natural levee that was the loci of historic settlement, the area has been much affected by spillway construction and subsequent sand borrowing operations, and the area has been subject to recent fill from the Bonnet Carre' crevasse (1874) and the Bonnet Carre' Spillway construction (post 1930). However, it is still possible that construction will uncover deeply buried archeological deposits associated with a relict distributary system. Similar borrowing operations in the study area have led to the discovery of numerous deeply buried archeological sites of significance including Bayou Jasmine (16SJB2), the Linsley site (16OR40), and the Paris Road site (16OR41).

PROPOSED RECREATION DEVELOPMENT PLAN

E.6.9. No recorded archeological sites or National Register or Register-eligible properties are located in the immediate area of the six proposed recreation sites. The proposed recreation sites consist of 2-acre developments with boat launching ramps, picnic tables, and a parking area.

E.6.10. Based on available data, three of the six proposed sites are in what are considered sensitive or high probability areas. These sites are the Rigolets, Cedar Point, and Wolf River sites. All are located on geomorphological features associated with prehistoric archeological sites. The Rigolets site is located on the southern edge of Prevost Island, a relict upland feature in the marsh near the Rigolets. Similar features in the lower Pearl River area are associated with significant archeological sites.

E.6.11. The two recreation sites in Mississippi, *Cedar Point and* Wolf River, are located near the mouths of the Jourdan and the Wolf rivers, respectively. Their location and the numerous recorded sites in the vicinity of these proposed recreation developments suggest the possibility of affecting as yet unrecorded archeological sites.

Section 7. REQUIREMENTS FOR FURTHER STUDY

E.7.1. The US Army Corps of Engineers responsibilities and procedures for identifying and administering historic and cultural properties are outlined in the Advisory Council on Historic Preservation regulations, "Protection of Historic and Cultural Properties," (Final Amendments 36 C.F.R. 800) and US Army Corps of Engineers regulation, "Identification and Administration of Historic Properties." The reader is referred to these regulations for details of the compliance process.

E.7.2. Briefly stated, an intensive cultural resources survey, including extensive subsurface testing of the impact area of the tentatively selected plan will be conducted during the next stage of project planning to determine the number and extent of the resources present. The survey will result in data adequate to determine resource eligibility for inclusion in the National Register of Historic Places. Any cultural resource determined eligible for inclusion would be avoided, protected, or, in the absence of a feasible alternative, mitigated by data recovery.

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APPENDIX F

ECONOMIC AND SOCIAL ANALYSIS

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Freshwater Diversion

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Appendix F

ECONOMIC AND SOCIAL ANALYSIS

F.0.1. This analysis provides an estimate of those project economic outputs creditable to the National Economic Development (NED) account under current Water Resources Council (WRC) guidelines. The general methodology employed is described in Section 1. Detailed computations of commercial fishery benefits for several scenarios are shown in Section 2. Dollar estimates of increased recreational outputs are presented in Section 3. Sections 4 and 5 summarize all NED benefits and costs and present benefit/cost ratios. The effects on benefits of changes in major assumptions used in the analysis are discussed in Section 6. Significant project effects of an economic nature that are not quantifiable are shown in Section 7. Section 8 contains an assessment of social impacts related to operation and construction of the project.

Section 1. GENERAL

STUDY AREA

F.1.1. The biological study area encompasses the lower Mississippi River, Lakes Maurepas, Pontchartrain, Catherine, and Borgne, the marshes bordering these lakes, and the Mississippi Sound and its surrounding wetlands. The direct economic study area consists of the nearby coastal areas in which the major project beneficiary, the oyster fishing and processing industry, is located. In addition, recreational benefits of the project are widely distributed throughout the general population of the immediate coastal area and surrounding upland parishes.

METHODOLOGY

F.1.2. The improved management and optimized salinity regimes in the study area that would result from project implementation would generate two categories of NED benefits, commercial fishing and recreation. Only one of several preliminary alternatives was considered capable of producing the optimized salinity pattern required to generate the benefits evaluated in this analysis. All benefits and costs are stated in terms of October 1983 price levels and are evaluated over a 50-year project economic life beginning in 1990. Present worth methods are used to evaluate pre- and post-base year benefit and cost streams using the current Federal discount rate of 8 1/8 percent, as required by the WRC.

COMMERCIAL FISHING

F.1.3. Habitat types in the study area were assessed on a with- and without-project basis in Appendix D, Natural Resources. This information is displayed in tables F-1-1 and F-1-2. As indicated in the tables, very little net habitat loss reduction can be attributed to the

TABLE F-1-1

COMPARISON OF HABITAT TYPES WITH AND WITHOUT PROJECT: LOUISIANA

(Acres)

	[illegible]		[illegible]		[illegible]		2010		2020		2030		2040	
	With	Without	With	Without	With	Without	With	Without	With	Without	With	Without	With	Without
[illegible]	[illegible]	[illegible]	[illegible]	45,516	[illegible]	43,291	41,174	41,174	39,161	39,161	37,247	37,247	35,426	35,426
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	116,868	105,681	102,638	94,433	90,140	84,555	79,164	75,880	69,525
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	51,111	52,646	48,126	49,944	45,315	47,400	42,668	45,001	[illegible]
[illegible]	[illegible]	[illegible]	129,626	129,626	119,740	123,288	114,496	117,261	[illegible]	111,528	104,763	106,075	100,251	100,889
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	45,604	41,411	41,411	37,603	37,603	34,145	34,145	31,065	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	206,798	197,055	194,446	186,308	182,888	176,257	[illegible]

[illegible]

[illegible] to bottomland hardwoods. Therefore, with and without project acreages were assumed to be the same.

[illegible] to saline marsh. Therefore, with- and without-project acreages were assumed to be the same.

TABLE F-1-2

COMPARISON OF HABITAT TYPES WITH AND WITHOUT PROJECT: MISSISSIPPI 1/

(Acres)

Habitat Type	1978 With	1978 Without	1990 With	1990 Without	2000 With	2000 Without	2010 With	2010 Without	2020 With	2020 Without	2030 With	2030 Without	2040 With	2040 Without
Bottomland Hardwoods	42,394	42,39	41,637	41,637	41,017	41,017	40,406	40,406	39,804	39,804	39,210	39,210	38,626	38,626
Wooded Swamp 2/	33,162	33,162	33,162	33,162	33,162	33,162	33,162	33,162	33,162	33,162	33,162	33,162	33,162	33,162
Fresh Intermediate Marsh	19,885	19,885	18,575	18,575	17,633	17,633	16,802	16,802	16,061	16,061	15,397	15,397	14,79[illegible]	14,79[illegible]
Brackish Marsh	19,942	19,942	19,515	19,515	19,167	19,167	18,825	18,825	18,489	18,489	18,159	18,159	17,834	17,834
Saline Marsh	27,325	27,325	26,580	26,580	25,975	25,975	25,384	25,384	24,806	24,806	24,241	24,241	23,690	23,690
Total Marsh	67,152	67,152	64,670	64,670	62,775	62,775	61,011	61,011	59,356	59,356	57,797	57,797	56,319	56,319

Source: US Army Corps of Engineers, New Orleans District

1/ No reductions in rates of habitat losses have been claimed in Mississippi. Therefore, with- and without-project acreages were assumed the same.

2/ Loss rate negligible

growth rate of gulf fishery oysters. The portion of this potential output that fishermen actually bring to the market place and the magnitude of their net returns (profit) have been addressed in the three scenarios.

SCENARIO I

F.2.16. The first scenario is the most conservative. In this scenario, it is assumed that the average productive potential of the reefs (Maximum Sustainable Yield) approximately doubles. The increase, however, only operates to reduce the aggregate cost of harvest by about 60 percent. No improvement in national per capita oyster consumption or increase in market share for study area fishermen is assumed. NED benefits are measured simply as the product of the average unit savings and average with-project landings.

SCENARIO II

F.2.17. In this scenario, national consumption trends are assumed to generate sufficient demand to gradually remove the total potential increase in oyster output from the market over a 10-year period (1992-2002). The same increased harvest efficiency as in Scenario I is assumed to be constant throughout the period of analysis on reefs operated by leaseholders. On the public reefs, where entry is unrestricted, fishermen are confronted by excess capital and labor competing for the resource. The competition prevents unit harvest costs from falling below present (without-project) levels. Total output and aggregate net returns increase, however, under this scenario.

F.2.13. Virtually all these problems can also be observed at the local level. Clearly, the first two issues, declining resource base and industry revitalization, can be directly addressed by construction of a freshwater diversion plan. Other issues can be indirectly influenced by mitigation of the first two issues. Similarly, any measurement of benefits ought to reflect the inter-relatedness of all of these issues. Total NED benefits can be expected to vary as a function of direct project impacts on these issues and of mitigation of nonproject related problems, particularly in the area of resource management policies, goals, and regulations.

WITH-PROJECT CONDITION

F.2.14. The with-project condition is usually defined as the most likely condition expected to exist in the future with a given plan. The project area oyster fishery is beset with many difficult problems. Therefore, selecting any single future state of the oyster industry as being the "most likely" is highly speculative within the meaning of the WRC Principles and Guidelines (P&G) requirements related to risk and uncertainity. Of the methods recommended in the P&G for dealing with risk and uncertainty, only a sensitivity analysis appears applicable or appropriate in this economic analysis. More refined analytic techniques and more detailed data either do not exist or are not economically obtainable. Assigning reasonable probabilities to the various potential outcomes is also not possible. Therefore, three future scenarios were evaluated. The different assumptions of the scenarios are felt to have captured the range of reasonable variation of the principal parameters that bear on project justification.

F.2.15. Each scenario proceeds from the same base projection of oyster reef potential productivity described in Appendix D, Natural Resources. This potential applies to years 2-50 of the project life, based on the

o Lack of industry influence on public decision making.

The total industry is composed of small units and often does not possess the capital to promote an image or to adequately present views among a complex array of external problems. Although there are associations representing harvesters and processors from the local to the national level, almost without exception individuals in the industry constantly voice the complaint that they have little influence on public policy makers.

o Precision of microbiological and chemical standards currently employed in classifying suitable growing waters and final products.

The current microbiological limits, based on a study on clams in the early 1940's, need further study and refinement, which may prove them to be overly discriminating. Additionally, improvements can be achieved in the manner in which chemical standards are developed.

o Research and services coordination.

There appears to be a lack of a specifically defined and coordinated systematic mission- or goal-oriented program of research or services to resolve many issues confronting the US oyster industry.

F.2.12. Based on these findings, the report concluded that the industry is in drastic need of revitalization. Cooperation and joint leadership through a small, dynamic government industry commission or task force are needed for the industry to become more economically viable. The report identifies specific needs in the areas of pollution abatement, expanding natural production, aquaculture, mechanization, new product development, marketing, financial assistance, multijurisdictional authorities and regulations, research and services coordination, social concerns, and leadership roles.

o Competition for use of growing waters and adjacent lands.

Competition for use of the coastal zone is a major issue confronting the oyster industry. Due to the industry's small size, lack of public awareness, and imprecisions of economic cost/benefit studies, the industry often is assigned a low priority when competing for coastal zone allocations.

o Multijurisdictional authorities and regulations.

The industry is regulated by many Federal, state, and local authorities, each having its own record keeping requirements. Major Federal regulatory and inspection responsibilities are shared by the Food and Drug Administration, the Environmental Protection Agency, the NMFS, and, to a lesser extent, the Occupational Safety and Health Administration and the US Army Corps of Engineers. Major state agencies in public health conservation and water pollution control are also involved. Other government bodies also affect the industry including local county agricultural committees and urban drainage authorities, local public works bodies, regional and multistate river basin commissions, and zoning authorities.

o Social concerns.

Oystering is one of the last holdouts of rugged individualism in America. The life is hard, but people continue to follow it because of the tradition that belongs to the trade, the feeling of freedom and independence, and the enjoyment of boats, water, and the outdoor life. The clean environment needed for the shellfish industry provides a pleasing aesthetic surrounding for those living and working in these areas. Pristine bays and estuarine waters make these areas desirable, as is reflected in higher real estate values. The decline of the oyster industry signals a change in all aspects related to the water.

Department of Commerce] was published. More than 120 individuals from the oyster industry and from involved governmental agencies participated in the survey. Eight dominant issues were identified:

o Decreasing resource.

The dramatic decline of US oyster production is attributed to three causes: (1) overharvesting in earlier years, (2) natural causes (disasters, diseases, and predators), and (3) human depredation of the environment. The Nation's oyster harvesting acreage is shrinking at an annual rate of 0.6 percent, principally because of closings due to water pollution. Physical alterations of the environment affect the currents and salinities, and pollution alters the productivity of the remaining beds by degrading the quality of water suitable for larvae and juveniles, thus interfering with the natural process of reproduction.

o Industry revitalization.

With the exception of a few large commercial operations, the character of the oyster industry has remained virtually unchanged for generations. Harvesting is done largely by individuals or family groups, often with inefficient gear. State and local harvesting quotas are established on public bottoms to conserve the resource and for social purposes. These restrictions are based largely on gear efficiencies, the number of harvesters, the resource, processing plant capabilities, and tradition. Many processing facilities are small, family-owned, labor-intensive, and marginally profitable. They are faced with fluctuating supplies of oysters, decreasing labor base, increasing costs, and new regulations and record keeping that decrease production efficiencies and further raise operating costs. Marketing oysters has been confined to the fresh, canned, and frozen items and there has been little new product development. Oyster prices are not keeping pace with inflation.

Of the 12 southern plants canning natural oysters in 1975, only three produced just canned oysters. Shrimp was the primary product canned in the other nine plants. Oysters made up more than half the production in only two cases. Two of the nine plants also canned blue crab and two canned other speciality items. The 1975 production of natural canned oysters totaled 343,084 standard cases (24 cans of 4-2/3 oz.) in southern plants.

F.2.10. Imports. Imported oyster products come in three forms: canned, frozen, and fresh shucked. Limited quantities of fresh shucked oysters are imported, mainly from Canada. Canned imports are cooked sterile products available as bisques, soups, stews, smoked oysters, or oysters in their own juice. In 1975, 76 percent of imported oysters were canned. Almost all canned imports are from Japan and Korea (Pacific oysters) and they affect the ability of Pacific and Gulf Coast oyster canners to compete because of reported lower production costs. Following a somewhat steady growth in the importation of canned oyster products, there was an increase of over 200 percent in 1972. Overall, oyster imports have tripled since 1975. Imported canned oyster products have generally replaced domestic canning with total supplies of oysters in the United States fluctuating between 64 and 79 million pounds since 1963 (averaging 70 million pounds meat weight).

WITHOUT-PROJECT CONDITION

F.2.11. The problems and needs of the project area oyster fishery are best appreciated when initially viewed in the context of the national oyster industry. Many similarities, as well as some significant differences, exist. The industry is faced with many problems such as resource depletion, competition for water bottoms, new regulations, and industry fragmentation. In March 1977, a survey of industry problems conducted under the aegis of the National Marine Fisheries Service [(NMFS)

1975 Sales of Oyster Products
(F.O.B. plant)

Eastern	Sales
Fresh shucked or steamed	$59,916,695
Canned	4,064,946
Breaded	5,389,104
Specialities, fresh or frozen	362,883
Specialities, canned	2,898,837
	$72,632,465
Pacific	
Fresh shucked	$5,436,332
Breaded	109,425
Specialties, canned	2,505,249
	$8,051,006
Byproducts	
Crushed shell and lime	$5,846,584
Grand Total	$86,530,055

F.2.9. The structure of the natural oyster canning industry is:

Sales	Number of plants
Less than $100,000	4
$100,000 to $250,000	2
$250,000 to $500,000	2
Over $500,000	4

(including the Gulf of Mexico) and the West Coast industry. The other most convenient division is between fresh shucked oysters and canned oysters.

F.2.7. Most of the plants are engaged in processing Eastern oysters. Of the 448 plants producing oyster products, 398 process Eastern oysters. Fresh shucked oyster products dominate production at 345 of the 398 plants. The remaining plants produce the following: steamed oysters (3), breaded oysters (31), frozen shucked oysters (3), specialties (4), canned oysters (including specialities) (3), and shell products (5). Some plants may do one or more stages of processing such as steaming and shucking. Therefore, because of duplication, the total does not add up to 398. The processing sector is composed primarily of a large number of small, family-owned businesses. Twenty-four percent of the plants have sales of $25,000 or less, which indicates that the annual production is about 2,600 to 2,800 gallons of oysters. Over a 200-day season, these plants would average about 13 gallons or less per day. The following table compares Eastern oyster processing plants relative to sales volume. The species most often produced in conjunction with oysters is blue crab, followed by shrimp, clams, and bay scallops. The tendency to process more than one species is much less prevalent than in seafood plants in general.

F.2.8. Canning of Eastern oysters presents an entirely different industry structure from processing fresh shucked oysters. While the fresh industry stretches from Maine to Texas, the canned pack of natural (canned in broth without condiments) Eastern oysters is confined primarily to the deep south (Louisiana--five plants, Mississippi--five plants, and South Carolina--two plants). Canned specialties are produced in New Jersey--one plant, South Carolina--two plants, and Louisiana--one plant. In the south, oyster canning is more likely to be a portion of the total production of a plant that produces other canned products.

public grounds to conserve the resource. Private growers, however, can often use efficient escalator and hydraulic dredge boats capable of harvesting up to 2,000 bushels per day with a two-man crew. In addition, private oyster farmers can harvest their beds throughout the year, but public areas are frequently closed 4 to 5 months of the year to conserve the resource.

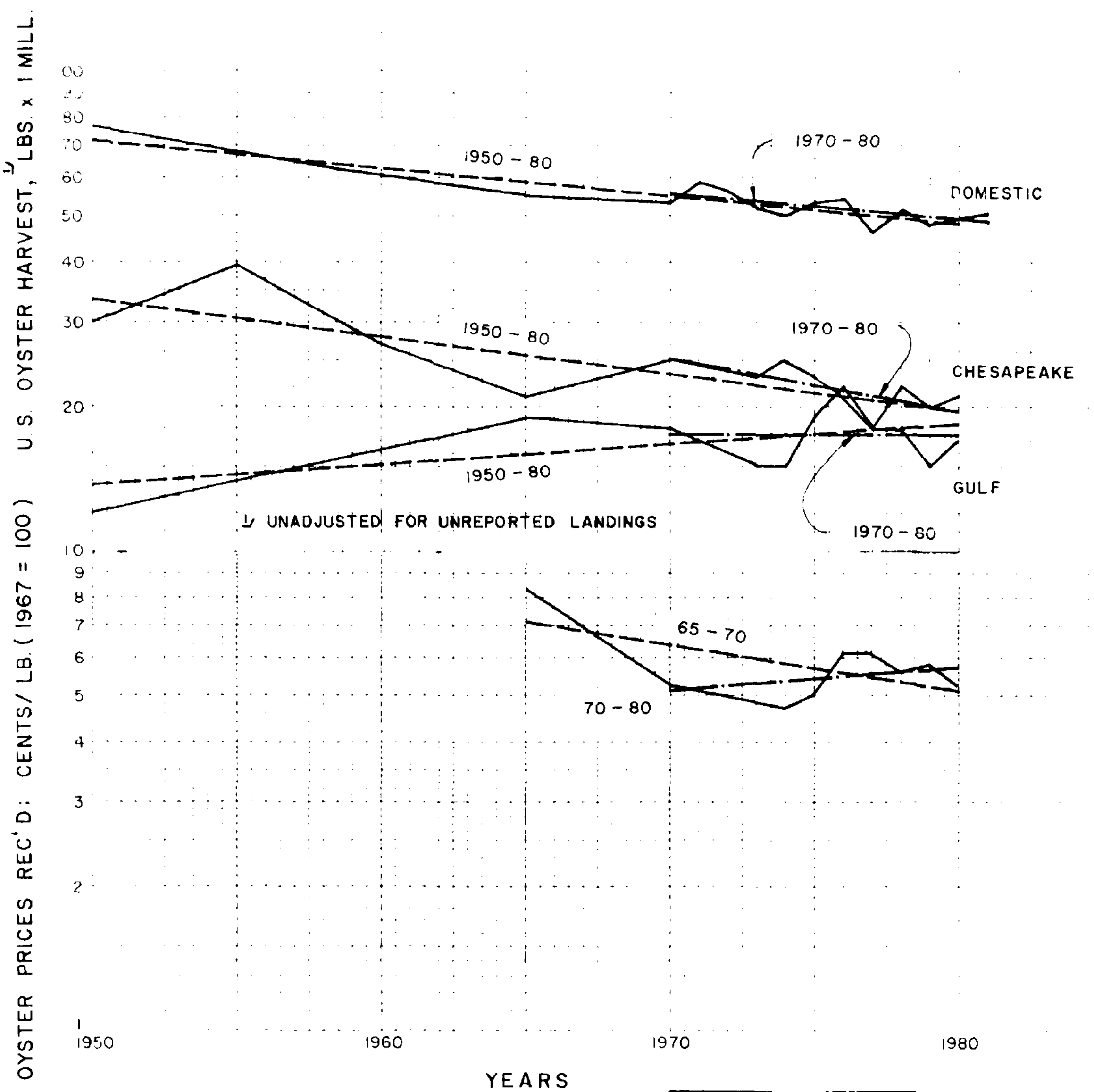
F.2.5. Processing Sector. Most oysters are sold as fresh and frozen shucked, steamed, or canned oyster products, including specialty products. The sale of oysters in the shell for raw consumption, although limited, has significant regional importance. Almost all of the oysters produced by oyster farms in Long Island Sound are sold for the raw bar trade. In Louisiana, private beds are harvested year-round to meet the high raw bar demands in New Orleans. By contrast, native Western and Pacific Coast oysters are not normally eaten raw. More US processing plants produce oyster products than products of any other single marine species. Oysters were processed in about 30 percent of the 1,476 processing plants in the United States (excluding Alaska and Hawaii). The total preliminary value of production at the plant level in 1975 was $81 million plus $5.8 million for crushed shell products. The final retail value of these products was at least $121 million, assuming a conservative 50-percent markup, and more likely was closer to $156 million.

F.2.6. Employment in the processing sector stood at 5,556 in 1975, down from 6,200 workers in 1971. In 1975, the Chesapeake Bay and Gulf of Mexico areas again had the highest number of employees, 2,519 and 1,891, respectively. The oyster processing industry provides mainly seasonal employment. The number of workers is half or less in the summer than during the peak fall and winter months. The industry is still labor-intensive and without many of the technological developments found in other seafood and processing industries. One way the oyster processing industry can be conveniently divided is into the Eastern oyster industry

oysters including about 8,700 full-time fishermen. By region, 5,887 were employed in the Chesapeake Bay area and 3,295 in the Gulf of Mexico region. The total number of oyster fishermen has decreased from 14,000 in the 1950's, probably because of the declining resource.

F.2.3. East and Gulf Coast Industry. The oyster industry on the East and Gulf Coasts harvests the American or Eastern oyster, *Crassostrea virginica*. This species ranges from Canada to Mexico. Maryland, Louisiana, Virginia, and Florida are the leading producers of Eastern oysters. The oyster thrives in protected and nutrient-laden estuaries and tolerates a wide range of salinities. Throughout its range, the growth rate is temperature dependent and includes considerable variation. In southern and Gulf states, market-size oysters can be produced in 2 years while from Chesapeake Bay and areas north, it takes 4 to 5 years to produce a market-size oyster.

F.2.4. Most of the harvest depends on natural recruitment. Naturally produced seed oysters from densely populated estuaries are transferred and planted on both public and private oyster growing areas. Environmental conditions and water quality are critical to oyster production and larva development and, therefore, it is essential that seed-producing areas be adequately protected. While hatchery operations are of increasing importance, they supply a relatively small percentage of the total seed production. Aquaculture is important to the natural production of oysters. In 1974, aquaculture activities accounted for approximately 40 percent of the US oyster harvest. The term "aquaculture" includes a wide array of activities from simple transferring of seed oysters to growing areas to the most sophisticated closed systems. Aquaculture is helping to replenish and stabilize wild populations that have declined drastically in the last 70 years as a result of pollution, natural disasters, and disease. Harvesting techniques vary and are frequently limited to inefficient labor-intensive methods on



MISSISSIPPI AND LOUISIANA ESTUARINE AREAS

OYSTER PRICES RECEIVED AND HARVEST

U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

APRIL 1984 FILE NO.

FIGURE F-1

TABLE F-2-1

DISTRIBUTION OF U.S. OYSTER LANDINGS[1/]

(Millions of lbs)

Year*	Domestic Landings[2/]	Chesapeake Catch	Gulf States Catch	All Other U.S.
1950	76.0	30.0	12.0	34.0
1960	60.0	27.0	16.0	17.0
1965	55.0	21.0	19.0	15.0
1970	53.6	25.0	18.0	10.6
1971	57.9	26.0[2/]	20.0[2/]	11.9
1972	56.1	24.0	18.0	14.1
1973	51.9	23.0	15.0	13.9
1974	50.2	25.0	15.0	10.2
1975	53.2	23.0	19.0	11.2
1976	54.4	21.0	22.0	11.4
1977	46.0	18.0	18.0	10.0
1978	51.0	22.0	18.0	11.0
1979	48.1	20.0	15.0	13.1
1980	49.1	21.0	17.0	11.1

*Record: 152,000,000 lbs in 1908.

Source: US Army Corps of Engineers, New Orleans District

[1/]Source: Except as noted, "Statistical Abstract of the U.S," Department of Commerce.

[2/]Source: "Fisheries Statistics of the U.S," National Marine Fisheries

Section 2. COMMERCIAL FISHING

PLANNING SETTING

INDUSTRY STATUS[1/]

F.2.1. Domestic landings of oysters have been declining for decades as shown in table F-2-1. For example, in 1929, 90 million pounds (meat weight) were landed and in the 1970's the average annual landings were 54 million pounds. Eastern oysters landed all along the East Coast account for most of the decrease in the harvest. There are several reasons for the decline including overfishing, natural disasters, oyster diseases (such as MSX and Dermocystidium), and the closure of waters because of pollution.

F.2.2. The value of the oyster harvest has increased despite the decreased landings, indicating a rise in exvessel prices. The harvest value in 1967 was \$32.2 million compared to \$45.6 million in 1975. When the effects of inflation are removed from the value of landings, however, exvessel prices in the 1968-1973 period actually declined compared to 1967 and then increased by 14 percent in 1975 (see figure F-1). This development can be compared to the doubling in prices paid to fishermen of all edible fish and shellfish since 1967. In the 1971-1975 period, the average annual harvest from public grounds was 31.6 million pounds (meat weight) and 20.9 million pounds from private grounds. The public and private acreage in 1975 was 817,057 and 442,088 acres, respectively. In 1973, there were 11,748 people harvesting

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[1/]Source: "A Comprehensive Review of the Commercial Oyster Industries in the United States," March 1977, US Dept of Commerce, National Marine Fisheries Service. Paragraphs F.2.1-F.2.10 are taken virtually intact from the survey.

project. Therefore, habitat-related commercial wildlife benefits were not evaluated. However, major project-related enhancement of oyster reef productivity on historically and currently worked reefs was identified. The market value of these enhancements to the commercial oyster fisherman makes up the major beneficial output of the project. Valuation of increased productivity is based on both reduction in harvest costs and increased total sales.

F.1.4. Three scenarios were quantified in detail. In the first scenario, benefits are based solely on reduced harvest costs with no increase in total sales. In the second scenario, harvest cost declines and sales gradually increase to the total productive capacity of the enhanced reefs. The final scenario assumes an immediate increase in sales equal to the increased productive capacity and reduction of harvest costs.

F.1.5. Dockside prices (exvessel) for oyster meat were obtained from published sources and normalized both for price levels and annual variation using the CPI Food Index and a simple mean of 1976-1980 prices. This price was then used to calculate operator revenues under each scenario. Harvest costs are based on a constructed estimate of total annual vessel costs, including returns to management.

RECREATION

F.1.6. As detailed in Appendix G, Recreation, relative increases in recreational opportunities based on habitat and facility capacities were quantified using fiscal year 1983 WRC unit day values (UDV) updated to 1984 fiscal year. These benefits are related to increased recreational use generated by six access sites constructed as part of the recommended plan.

SCENARIO III

F.2.18. Scenario III is similar to Scenario II except that all additional output is immediately taken by the market. As in the other scenarios, profitability remains high during the entire study period for leaseholders. Fishermen using public reefs initially enjoy the same reduced cost of harvest. A combination of high profitability and unrestricted entry then operates to drive unit net returns down to pre-project levels over an assumed 10-year period.

NED BENEFIT CALCULATION

PROJECTED CONSUMPTION

F.2.19. The relatively poor long-term market performance of the domestic oyster industry compared to all shellfish and all fish products is shown in table F-2-2 and summarized in figure F-2. Over 85 percent of the total domestic oyster production is accounted for by the Gulf of Mexico and Chesapeake Bay fisheries. Long-term trends, unadjusted for estimated unreported landings, are shown on figure F-1B. Adjusted data[2/] for these areas as well as for the project study area and other US landings are shown on table F-2-3 and on figure F-3. As indicated on the figures, the gulf fishery oyster harvest has grown until it now

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[2/] The Louisiana and Mississippi adjusted data reflect a 150 percent increase in reported landings based on Mackin and Hopkins (1962) and Lindall et al. (1979). Alabama landings have been increased by 100 percent. No adjustment was considered necessary to the Texas and Florida reported landings, according to fish and wildlife personnel in each of these states. Chesapeake Bay reported landings are regarded as accurate. No attempt was made to account for unreported landings, if any, for the relatively minor remaining portion of the national oyster harvest.

TABLE F-2-2

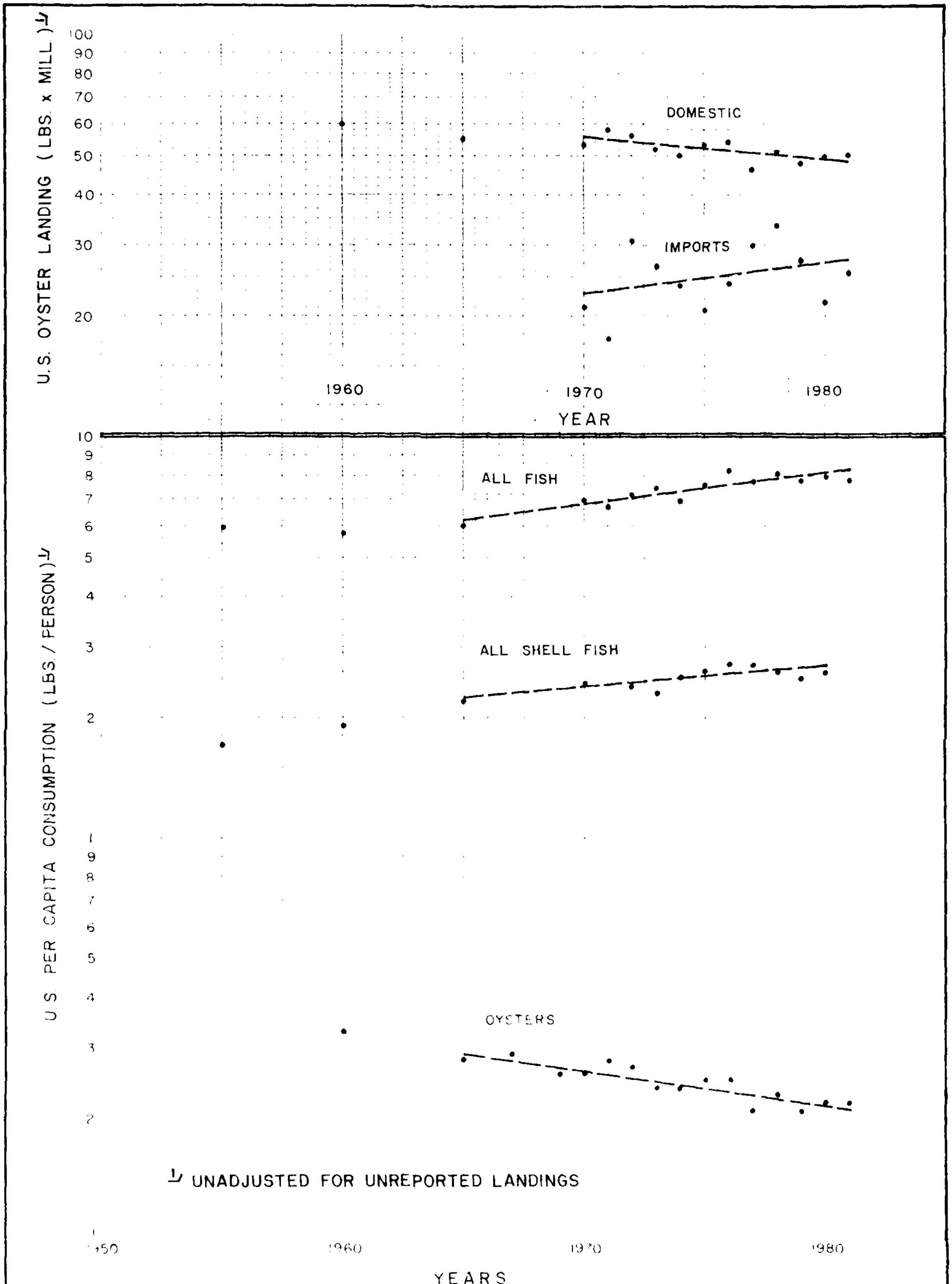
PER CAPITA CONSUMPTION (PCC)

Fish and Shellfish

Year	U.S. Population 2/ (Millions)	Domestic Oyster 1/ 2/ Landings (Million lbs)	PCC (lbs/Person)		
			Oysters 3/	All Shellfish 1/ 2/	All Fish 1/
1950	151.9	76.0	.50	1.6	6.3
1960	180.0	60.0	.33	1.9	5.7
1965	193.5	55.0	.28	2.2	6.0
1970	204.0	53.6	.26	2.4	6.9
1971	206.8	57.9	.28	2.4	6.7
1972	209.3	56.1	.27	2.4	7.1
1973	211.4	51.9	.24	2.3	7.4
1974	213.3	50.2	.24	2.5	6.9
1975	215.5	53.2	.25	2.6	7.5
1976	217.6	54.4	.25	2.7	8.2
1977	219.8	46.0	.21	2.7	7.7
1978	222.1	51.0	.23	2.6	8.1
1979	224.6	48.1	.21	2.5	7.8
1980	227.2	49.1	.22	2.6	8.0
1981	229.3	50.0	.22	2.7	7.8

Source: US Army Corps of Engineers, New Orleans District

1/ Source: "Fisheries of the US," National Marine Fisheries Service. Various years.
2/ Source: "Statistical Abstract of the U.S," Department of Commerce
3/ Calculated



MISSISSIPPI AND LOUISIANA ESTUARINE AREAS

PER-CAPITA CONSUMPTION AND OYSTER LANDINGS

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

APRIL 1984 FILE NO.

FIGURE F-2

TABLE F-2-3

U.S. DOMESTIC OYSTER LANDINGS (DREDGE AND TONG)

Corrected For Estimates Of Unreported Landings[1/]

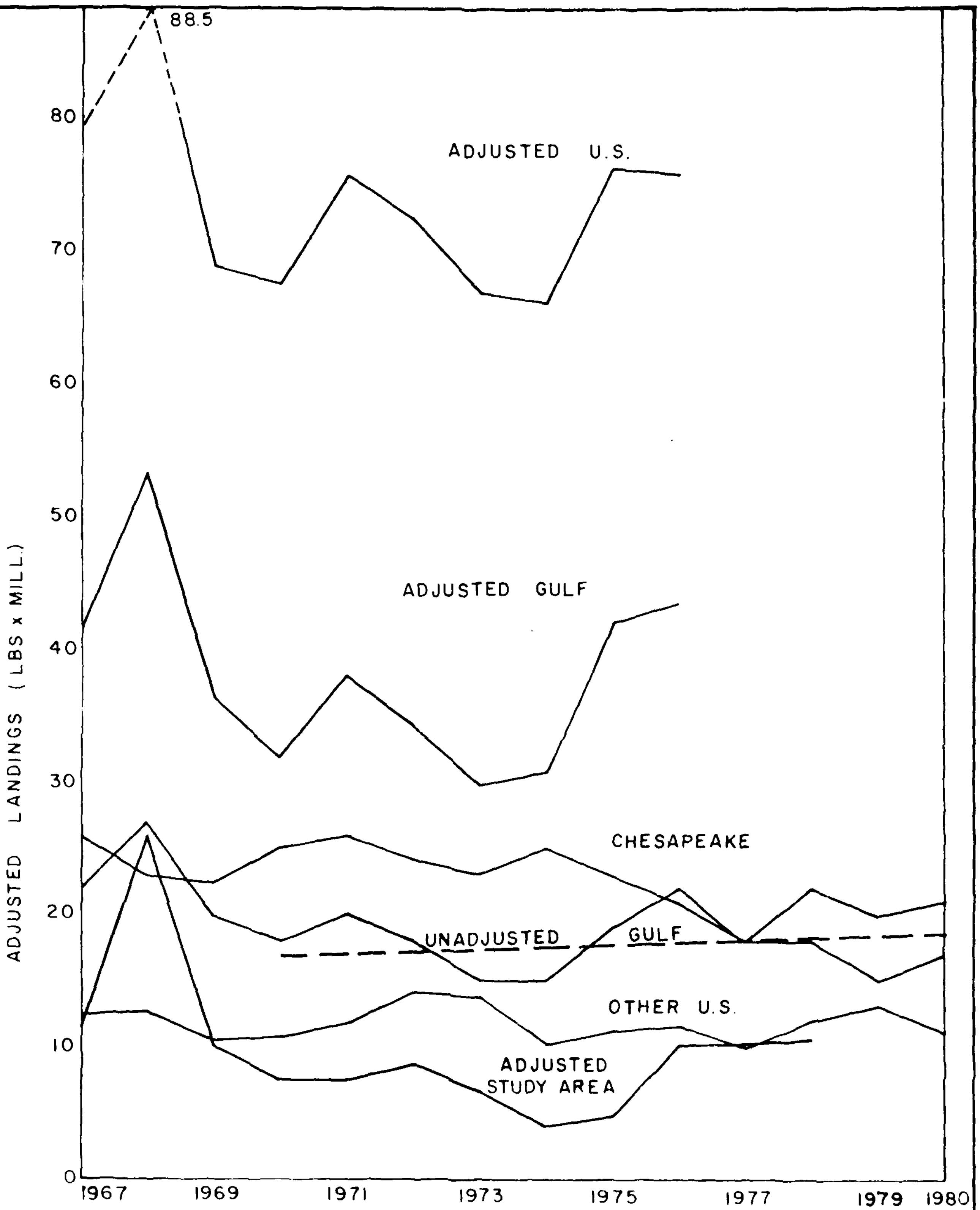
(Millions of lbs)

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976[2/]
Gulf										
Texas	3.6	3.3	3.8	4.7	4.7	3.9	2.3	1.2	1.8	3.9
Louisiana	19.4	32.8	22.9	21.6	26.3	22.0	22.4	24.9	34.2	30.8
Mississippi	9.5	9.5	3.6	1.4	3.0	3.0	1.5	0.7	2.7	3.8
Alabama	4.2	2.4	1.0	0.6	0.5	2.1	1.2	1.5	1.3	2.5
Florida	4.6	5.3	4.9	3.6	3.5	3.2	2.4	2.6	2.1	2.6
Subtotal	41.3	53.3	36.2	31.9	38.0	34.2	29.8	30.9	42.1	43.6
Chesapeake Bay	25.8	22.7	22.2	25.0	26.0	24.0	23.0	25.0	23.0	21.0
Other U.S	12.4	12.5	10.3	10.6	11.9	14.1	13.9	10.2	11.2	11.4
Total U.S.	79.5	88.5	68.7	67.5	75.9	72.3	66.7	66.1	76.3	76.0
Study Area:	11.3	25.8	10.0	7.4	7.3	8.8	6.7	4.0	4.8	10.2

Source: US Army Engineer District, New Orleans District

1/Add: TX, FL + 0%; LA, MS + 150%; AL + 100%.

2/Later data not available on a state level disaggregation.



MISSISSIPPI AND LOUISIANA ESTUARINE AREAS

ADJUSTED
LANDINGS

US ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

APRIL 1984 FILE NO.

FIGURE F-3

surpasses the historically dominant Chesapeake Bay harvest. The growth partially offsets the long-term decline in the Chesapeake Bay fishery. The contribution of the study area fishery is somewhat more difficult to assess since the yearly variation in landings data increases rapidly as the area analyzed grows smaller, i.e., one or two "outlyers" produce dramatic changes in trend lines. Figure F-4, however, indicates that during the 1970's, the study area fishery did about as well as the rest of the gulf, if pre-1968 data are ignored. Further, if state-wide data are disaggregated into harvest by dredge and tong, Louisiana and Mississippi appear as very efficient performers in terms of total landings and landings per fisherman (figure F-5) compared to Chesapeake Bay.

F.2.20. The three scenarios use as their bases varying projected levels of national demand. This demand, in turn, was generated as the product of OBERS population projections for the United States and two projected levels of per capita consumption. In Scenario I, per capita consumption from figure F-2 was projected to decline to 0.20 lbs/person by 1990 and assumed to remain constant thereafter (figure F-6)[3/]. Scenarios II and III are based on a gradual return to per capita consumption levels of the 1950's, which represented a relatively stable level of consumption. The projection and supporting data are presented on figure F-7, table F-2-4, and in Exhibit 1.

F.2.21. NMFS uncorrected data (1970-1976) for the Louisiana portion of the study area were used to disaggregate base year harvest into landings by dredge and tong and further into landing from private (leased) areas and public areas (table F-2-5). Since no clear trend is apparent, these data (corrected for unreported landings) were used as the 1990 base year

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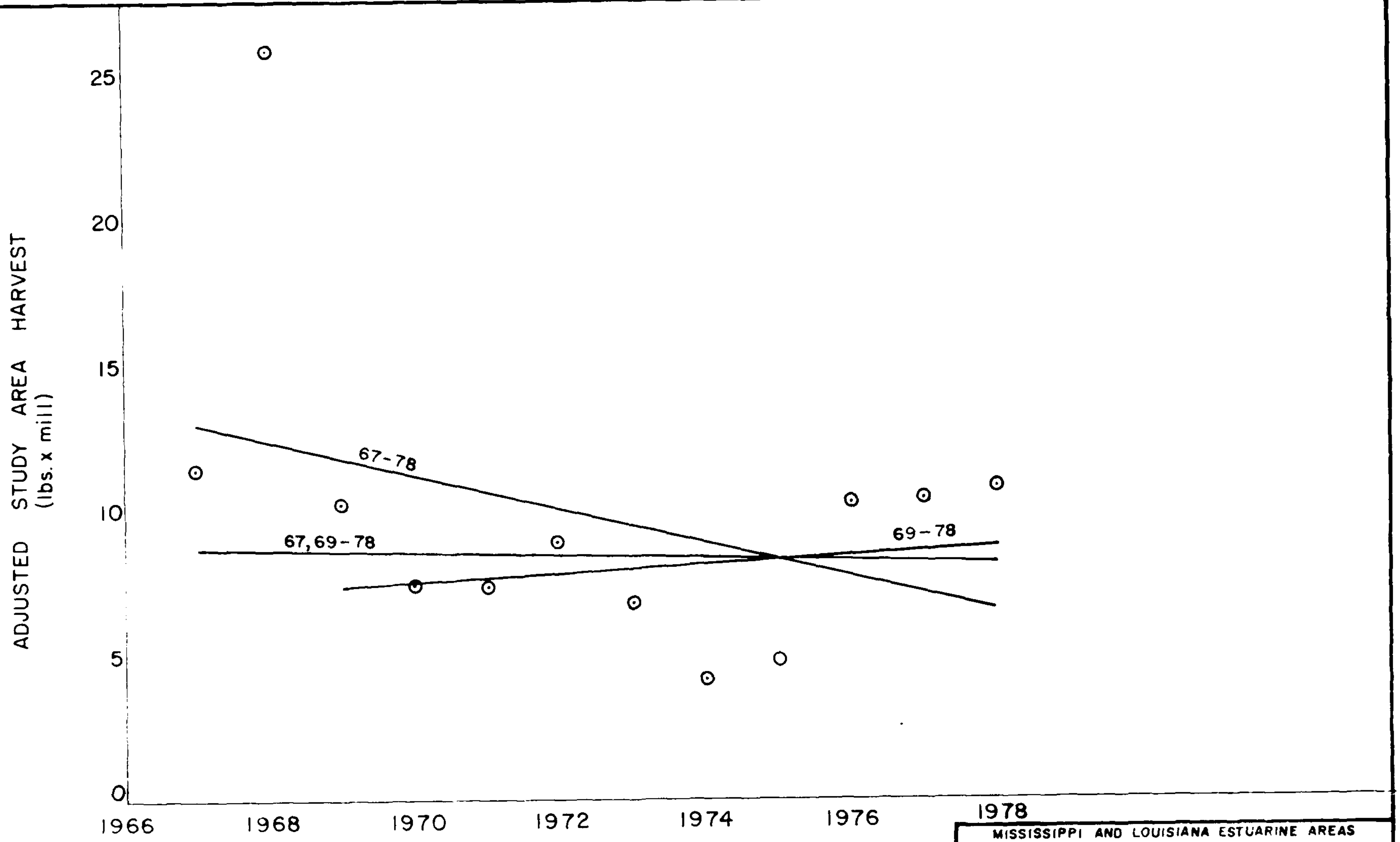
[3/] Per capita consumption projection methodology is presented in Exhibit 1.



MISSISSIPPI AND LOUISIANA ESTUARINE AREAS

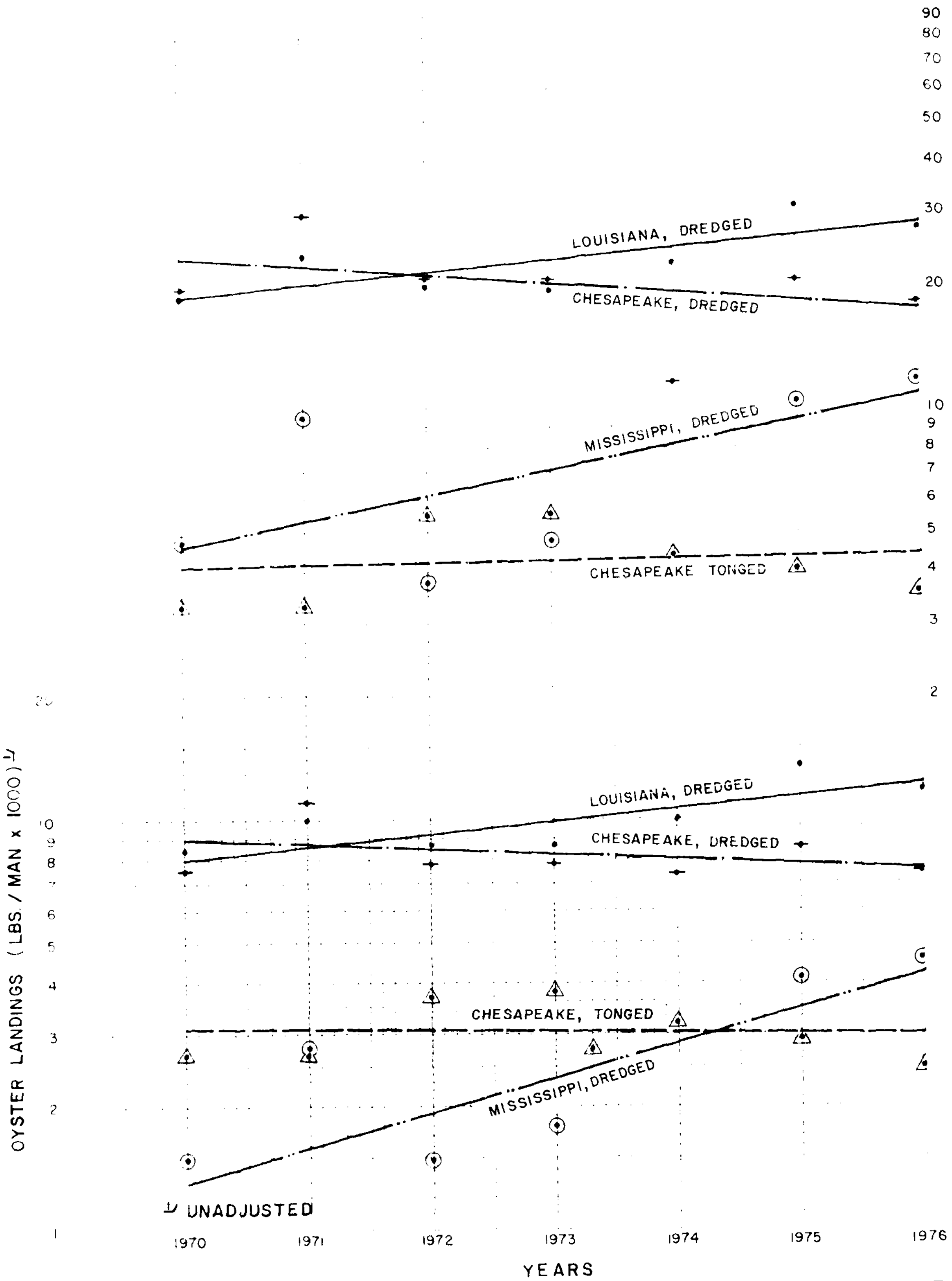
ADJUSTED STUDY AREA HARVEST

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

APRIL 1984 FILE NO.

FIGURE F-4

FIGURE F-4



MISSISSIPPI AND LOUISIANA ESTUARINE AREAS

OYSTER LANDINGS

U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

APRIL 1984 FILE NO

FIGURE F-5

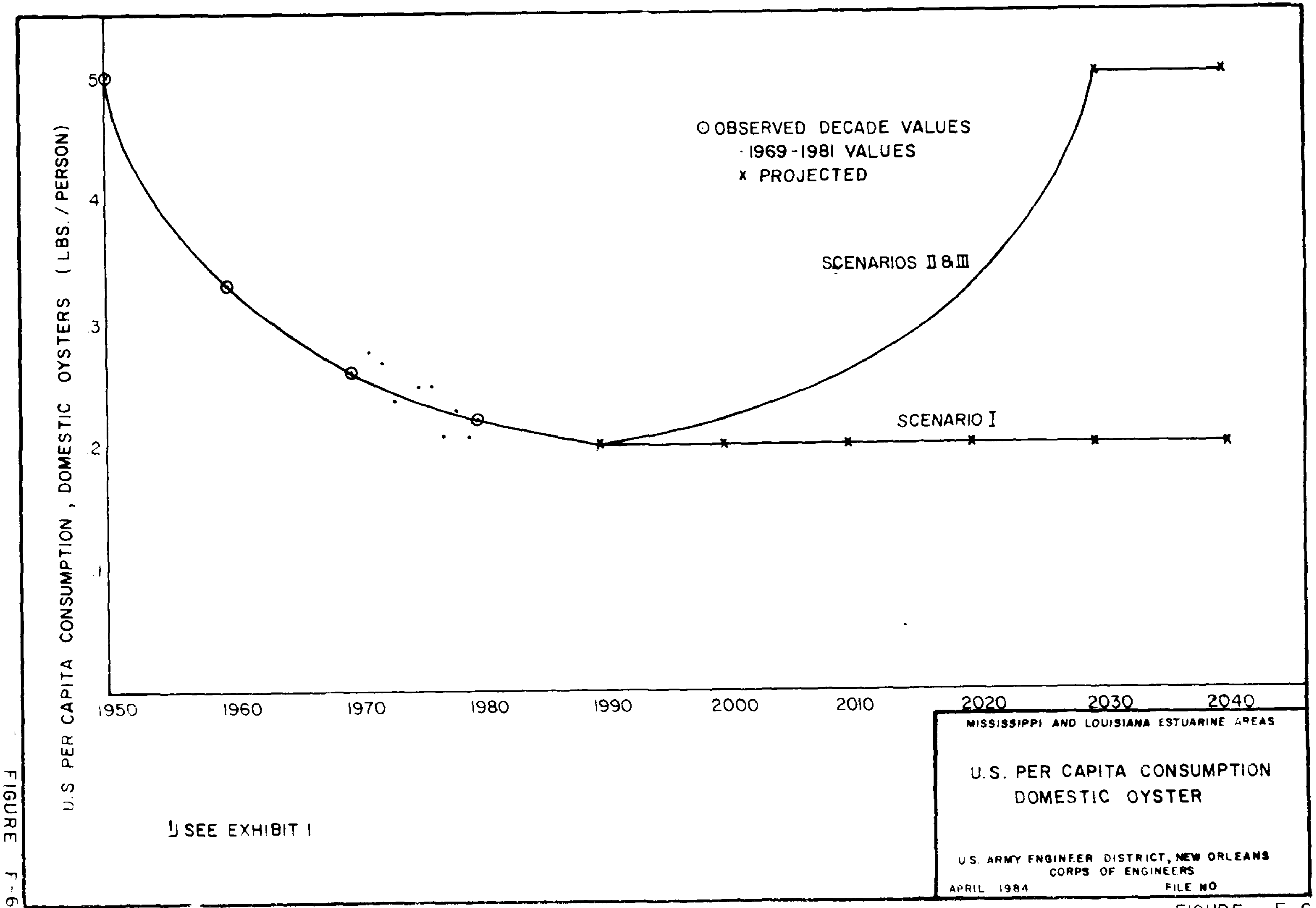
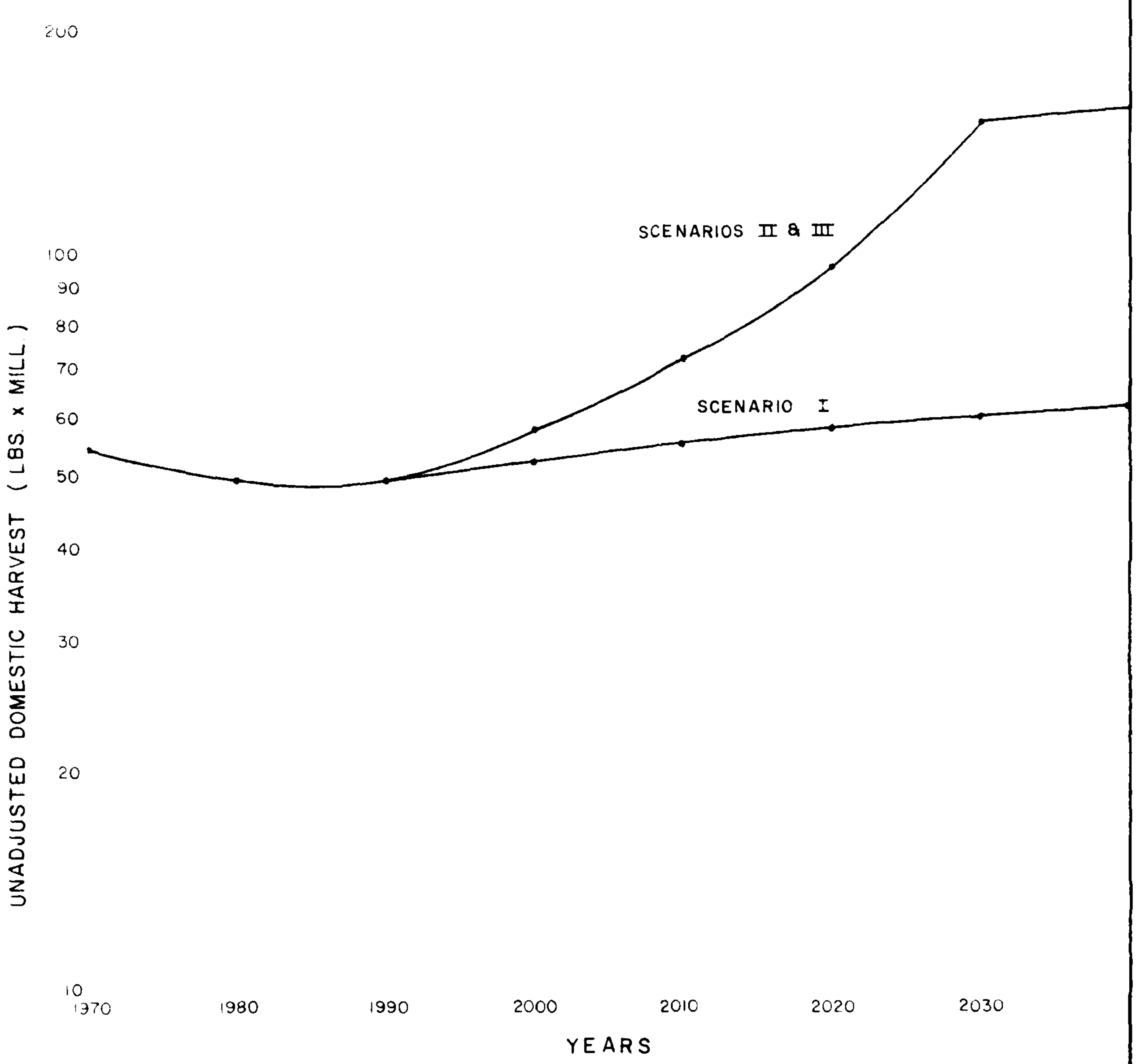


FIGURE F-6

FIGURE F-6



MISSISSIPPI AND LOUISIANA ESTUARINE AREAS

PROJECTED DEMAND

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

APRIL 1984 FILE NO.

FIGURE F-7

TABLE F-2-4

PROJECTED U.S. OYSTER CONSUMPTION

Year	U.S. Population 1/ (Millions)	Scenario I		Scenarios II and III	
		Per Capita Consumption 3/	Total Consumption 4/	Per Capita Consumption 3/	Total Consumption 4/
1990	243.0	.20	48.6	.20	48.6
2000	259.8	.20	52.0	.22	57.2
2010	274.8	.20	55.0	.26	71.4
2020	289.6	.20	57.9	.33	95.6
2030	299.8	.20	60.0	.50	149.9
2040	310.0 2/	.20	62.0	.50	155.0

1/ Source: OBERS, Department of Commerce

2/ Estimated

3/ lbs/person

4/ lbs. x 1,000,000

TABLE F-2-5

WITHOUT-PROJECT OYSTER HARVEST DISTRIBUTION

Year	%Catch Landed by Dredge [1]		Louisiana Adjusted Harvest (lbs. x 1000) [3]			Mississippi Adjusted Harvest (lbs. x 1000) [3]		
	Louisiana [2]	Mississippi [2]	Total	Dredged	Tonged	Total	Dredged	Tonged
1970	8.4/8.6=0.98	0.5/0.5=1.00	7110	6968	142			
1971	10.3/10.5=0.98	1.1/1.2=0.92	7020	6880	140			
1972	8.8/ 8.8=1.00	0.6/1.2=0.50	6630	6630	0		(See text F.2.19.)	
1973	8.8/ 9.0=0.98	0.5/0.6=0.83	6150	6027	123			
1974	9.8/10.0=0.98	0	4020	3940	80			
1975	13.5/13.7=0.98	1.0/1.1=0.91	4508	4418	90			
1976	12.2/12.3=0.99	1.3/1.5=0.87	7332	7259	73			
Average:	98%	82%	6110	x 98% 6017	92	1,883	x 82% 1,544	339

1/ Source: "Fishery Statistics of the US," National Marine Fisheries Service

2/ Unadjusted harvest for entire state, lbs x 1,000,000.

3/ Study area only.

average harvest from Louisiana. The Mississippi data were similarly disaggregated. However, state fisheries statistics based on tax receipts from 1979-1982, which are considered highly accurate, as well as NMFS data, were used to estimate the average base year catch from the Mississippi portion of the study area (table F-2-6). These average landings are estimated to remain unchanged if no action is taken and comprise the future without-project condition.

DREDGED HARVEST

F.2.22. Study area dredged harvest, number of vessels, and the estimates of annual vessel cost shown on tables F-2-7, F-2-8, and F-2-9 were used to estimate a short-run average unit harvest cost for available data. Data were fitted to an exponential curve of the shape ln y = ln b + mx, where y equals unit harvest cost and x equals adjusted study area harvest (figure F-8).

F.2.23. With-project harvest cost reductions are based on both the increased oyster density and improved vitality described in Appendix D, Natural Resources. Average with-project potential harvest has been estimated at 15,500,000 pounds, of which approximately 14,600,000 pounds could be landed by dredge [4/], with the remainder representing potential harvest by tongs. Based on figure F-8, the unit harvest cost associated with this potential harvest is $0.43/lb.

[4/] NMFS statistics indicate about 82 percent of Mississippi landings and 98 percent of Louisiana landings are by dredge.

TABLE F-2-6

MISSISSIPPI OYSTER HARVEST[1/]

Year	Pounds
1967	5,541,500
1968	7,094,000
1969	1,476,750
1970	310,750
1971	316,000
1972	2,135,250
1973	586,750
1974	17,750
1975	249,500
1976	2,870,000
1977	3,306,750
1978	1,502,500
1979	41,000
1980	10,200
1981	1,559,900
1982	3,117,100
16 year total =	30,135,700
Annual average =	1,883,481 pounds/year

Source: US Army Corps of Engineers, New Orleans District

1/ Harvest values from 1967-1978 are based on NMFS data and have been increased by 150% (x2.5) to account for unreported landings. Values from 1979-1982 were provided by the Mississippi Bureau of Marine Resources and are considered to be accurate.

tion 3. RECREATION

MMARY OF METHODOLOGY

3.1. A regional analysis was used to determine recreational needs. e analysis is a generalized way of presenting recreational pply/demand relationships for land and water use within the project creational market area and similar to that used by many states in eparing their Statewide Comprehensive Outdoor Recreation Plan (SCORP). pendix G, Recreation, contains the detailed analysis.

3.2. The analysis had three objectives: to determine the demand for e primary water-based and land-based recreational activities within e project market area, to translate demands for these activities into cility needs, and to use this information in identifying impacts and tentials for recreational and fish and wildlife development in the oject areas.

3.3. The scope of the analysis covered 10 southeastern Louisiana rishes and three Mississippi counties that form the project market ea. Demand and need are projected for target years 1990 and 2040, anning the portion of the project life for which projections can alistically be made.

3.4. The demand-need determination is composed of three elements: mand, supply, and need. Need is defined as that amount remaining when l demand is compared with the existing supply (demand - supply = ed).

3.5. Specific activities were identified that would be directly fected if the project were implemented. How the activity and the level use would be affected by freshwater introduction was then determined.

TABLE F-2-13

TONG HARVEST

Benefit Summary
(1983 Prices)

Scenario	Average Annual Benefits
I	$55,000
II	$390,000
III	$585,000

TABLE F-2-14

OYSTER FISHERY

Benefit Summary
(1983 Prices)

Scenario	Dredged Harvest	Tonged Harvest	Total
I	$4,447,000	$55,000	$4,502,000
II	$5,058,000	$390,000	$5,448,000
III	$7,992,000	$585,000	$8,577,000

shery industry are approximately 15 percent of gross exvessel value or
out $0.24/lb. Since there are no restrictions to entry on the public
efs that support virtually all tonging, with-project unit costs are
ated in a manner similar to the public dredge cost scenarios, i.e.,
percent initial reduction in cost with-project.

st of Harvest Scenarios - Tong Sector

Scenario I: 62 percent reduction; no increase in sales

Scenario II: 0 percent reduction; gradual increase in sales to 900,000 lbs/yr.

Scenario III: 62 percent initial reduction, reducing to 0 percent in 10 years; gradual increase in sales to 900,000 lbs/yr.

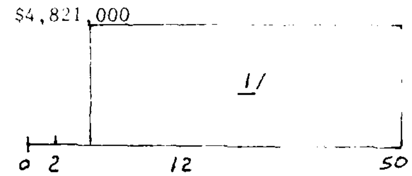
.2.29. Table F-2-13 summarizes the annual average NED savings to
onging operations under each with-project scenario. Table F-2-14
ummarizes NED benefits to both segments of the fishery under each
cenario.

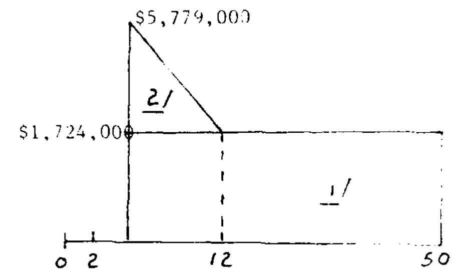
TABLE F-2-12 (CONTINUED)

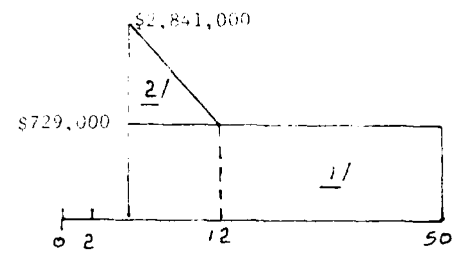
SCENARIO III - DREDGED HARVEST

Benefit Summary
(1982 Prices)

Average Annual Values		
Louisiana Leased:	1/ Increased net return, yrs 2-50:	$4,821,000
	PVA 1/yr, 48 yrs, 8 1/8%:	x 12.0181
	PVI, 2 yrs hence, 8 1/8%:	x .85536
	I&A, 50 yrs, 8 1/8%:	x .08292
	Average Annual Value:	$4,109,000
Louisiana Public:	1/ Increased net return, yrs 2-50:	$1,724,000
	PVA 1/yr, 48 yrs, 8 1/8%:	x 12.0181
	PVI, 2 yrs hence, 8 1/8%:	x .85536
	I&A, 50 yrs, 8 1/8%:	x .08292
	Subtotal: Average Annual Value:	$1,470,000
	2/ Maximum increase, year 2:	$5,779,000
	Year 12 Value:	-1,724,000
	Average annual decreasing annuity:	486,000
	PV-A, 10 yrs, 8 1/8%:	x 40.95492
	PVI, 2 yrs hence, 8 1/8%:	x .85536
	I&A, 50 yrs, 8 1/8%:	x .08292
	Decreasing Annuity Subtotal, Average Annual Value:	$1,179,000
	Total: Average Annual Value:	$2,649,000
Mississippi Public:	1/ Increased net return, yrs 2-50:	$ 729,000
	PVA 1/yr, 48 yrs, 8 1/8%:	x 12.0181
	PVI, 2 yrs hence, 8 1/8%:	x .85536
	I&A, 50 yrs, 8 1/8%:	x .08292
	Subtotal: Average Annual Value:	$ 621,400
	2/ Maximum increase, year 2:	$2,841,000
	Year 12 value:	- 729,000
	Average annual decreasing annuity:	$ 211,200
	PV-A, 10 yrs, 8 1/8%:	x 40.95492
	PVI, 2 yrs hence, 8 1/8%:	x .85536
	I&A, 50 yrs, 8 1/8%:	x .08292
	Subtotal: Average Annual Value:	$ 613,000
	Total: Average Annual Value:	$1,234,000
GRAND TOTAL, SCENARIO III		$7,992,000







Source: US Army Corps of Engineers, New Orleans District

SCENARIO III - DREDGED HARVEST

Benefit Summary
(1983 Prices)

	Louisiana Leased	Louisiana Public	Mississippi Public	Total
Without-project harvest:	3,731,000 lbs.	2,286,000 lbs.	1,544,000 lbs.	7,561,000 lbs.
Unit harvest cost:	x 1.12	1.12	x 1.12	x 1.12
Total:	$4,179,000	$2,560,000	$1,729,000	$ 8,468,000
Without-project gross return1/:	$5,970,000	$3,658,000	$2,470,000	$12,098,000
Less harvest cost:	-4,179,000	-2,560,000	-1,729,000	-8,468,000
Without-project, net return:	$1,791,000	$1,098,000	$ 741,000	$ 3,630,000
With-project harvest, year 2:	5,651,000 lbs.	5,878,000 lbs.	3,062,000 lbs.	14,591,000 lbs.
Unit harvest cost:	x $0.43	x $0.43	x $0.43	x $0.43
Total:	$2,430,000	$2,528,000	$1,317,000	$ 6,275,000
With-project gross return, year 2:	$9,042,000	$9,405,000	$4,899,000	$23,346,000
Less harvest cost:	-2,430,000	-2,528,000	-1,317,000	6,275,000
With-project net return, year 2:	$6,612,000	$6,877,000	$3,582,000	$17,071,000
Year 2 increase in net return:	$4,821,000	$5,779,000	$2,841,000	$13,441,000
With-project harvest, years 12-50:	5,651,000 lbs.	5,878,000 lbs.	3,062,000 lbs.	14,591,000 lbs.
Unit harvest cost:	x $0.43	x $1.12	x $1.12	-
Total:	$2,430,000	$6,583,000	$3,429,000	$12,442,000
With-project gross returns, years 12-50:	$9,042,000	$9,405,000	$4,899,000	$23,346,000
Less harvest cost:	-2,430,000	-6,583,000	-3,429,000	-12,442,000
With-project net return, years 12-50:	$6,612,000	$2,822,000	$1,470,000	$10,904,000
Years 12-50 increase in net returns:	$ 4,821,000	$1,724,000	$ 729,000	$ 7,274,000

1/ @ $1.60/lb.

years, unit harvest costs gradually return to without-project values for the public areas although net returns are still higher, reflecting the increase in total harvest. This scenario is summarized on table F-2-12. The average annual NED benefits attributable to Scenario III are $7,992,000.

TONG HARVEST

F.2.27. Oystermen who harvest by tonging typically use a 16- to 18-foot skiff powered by outboard motor carrying one or two persons; the second person cleans the catch. This method is largely confined to public reefs. Tongers harvest for 6 to 8 hours each and usually return to shore by early afternoon. Normal daily catches range from 10 to 15 barrels. Compared to Chesapeake Bay, where as much as 80 percent of the harvest is taken by tonging, this labor-intensive method accounts for very little of the study area catch. In some years, in fact, no landings by tong are recorded. For the period 1970-1976, only about 2 percent of the Louisiana harvest and 18% of the smaller Mississippi harvest were taken by tongs. Based on the adjusted base year landings for each state, this tong harvest would amount to about 430,000 lbs (table F-2-5) of oyster meat annually with- and without- project under Scenario I. The ultimate potential of the tong sector would amount to about 900,000 lbs. per year.

F.2.28. Due to the relatively small magnitude of the tong harvest, no attempt was made to detail unit operating cost savings to these operators. However, using information cited in the August 1977 Marine Fisheries Review[5/], it is estimated that costs to this segment of the

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[5/] Source: "Development of an Aquacultural Program for Rehabilitation of Damaged Oyster Reefs in Mississippi," Clyde L. MacKenzie, Jr.

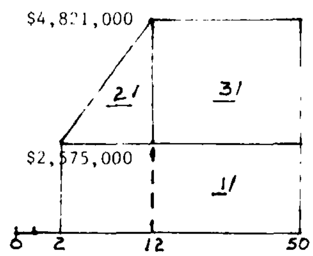
TABLE F-2-11 (CONTINUED)

SCENARIO II - DREDGED HARVEST

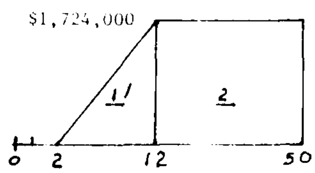
Benefit Summary
(1983 Prices)

Average Annual Values

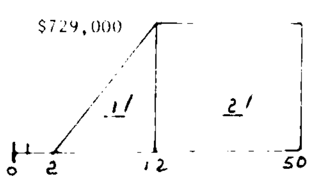
Louisiana Leased:	1/ Increased net return, yrs 2-50:	$2,575,000
	PVA 1/yr, 48 yrs, 8 1/8%:	x 12.0181
	PV1, 2 yrs hence, 8 1/8%:	x .85536
	I&A, 50 yrs, 8 1/8%:	x .08297
	Subtotal: Average Annual Value	$2,195,000
	2/ Maximum increase, year 12:	$4,821,000
	Year 2 Value:	-2,575,000
	Average annual increasing annuity:	$2,246,000
	PV+A, 10 yrs, 8 1/8%:	x 32.4416
	PV1, 2 yrs hence, 8 1/8%:	.85536
	I&A, 50 yrs, 8 1/8%:	.08292
	Subtotal: Average Annual Value	$ 517,000
	3/ Increased net return, yrs 12-50:	$4,821,000
		-2,575,000
		$2,246,000
	PVA 1/yr, 38 yrs, 8 1/8%:	x 11.675300
	PV1, 12 yrs hence, 8 1/8%:	x .39164
	I&A, 50 yrs, 8 1/8%:	x .08292
	Subtotal: Average Annual Value	$ 852,000
	Total: Average Annual Value	$3,564,586 (3,565,000)



Louisiana Public:	1/ Increased net return, yrs 12-50:	$1,724,000
	Average yearly increase, yrs 2-12:	172,000
	PV+A, 10 yrs, 8 1/8%:	x 32.4416
	PV1, 2 yrs hence, 8 1/8%:	x .85586
	I&A, 50 yrs, 8 1/8%:	x .08292
	Subtotal: Average Annual Value	$ 395,766
	2/ Increased net return, yrs 12-50:	$1,724,000
	PVA 1/yr, 38 yrs, 8 1/8%:	x 11.67530
	PV1, 12 yrs hence, 8 1/8%:	x .39164
	I&A, 50 yrs, 8 1/8%:	x .08292
	Subtotal: Average Annual Value	$ 653,660
	Total: Average Annual Value	$1,049,426



Mississippi Public:	1/ Increased net return, yrs 12-50:	$ 729,000
	Average yearly increase, yrs 2-12:	73,000
	PV+A, 10 yrs, 8 1/8%:	x 32.4416
	PV1, 2 yrs hence 8 1/8%:	x .85536
	I&A, 50 yrs, 8 1/8%:	x .08292
	Subtotal: Average Annual Value	$ 168,000
	2/ Increased net return, yrs 12-50:	$ 729,000
	PVA 1/yr. 38 yrs, 8 1/8%:	x 11.67530
	PV1, 12 yrs hence, 8 1/8%:	x .39164
	I&A, 50 yrs, 8 1/8%:	x .08292
	Subtotal: Average Annual Value	$ 276,000
	Total: Average Annual Value	$ 444,000



GRAND TOTAL, Scenario II		$5,058,000

Source: US Army Corps of Engineers, New Orleans District

TABLE F-2-11

SCENARIO II - DREDGED HARVEST

Benefit Summary
(1983 Prices)

	Louisiana Leased	Louisiana Public	Mississippi Public	Total
Without-project harvest:	3,731,000 lbs.	2,286,000 lbs.	1,544,000 lbs.	7,561,000 lbs.
Unit harvest cost:	x $1.12	x $1.12	x $1.12	x $1.12
Total:	$ 4,179,000	$ 2,560,000	$ 1,729,000	$ 8,468,000
Without-project gross return 1/:	$ 5,970,000	$ 3,658,000	$ 2,470,000	$12,098,000
Less harvest cost:	-4,179,000	-2,560,000	-1,729,000	-8,468,000
Without project, net return:	$ 1,791,000	$ 1,098,000	$ 741,000	$ 3,630,000
With-project harvest, year 2:	3,731,000 lbs.	2,286,000 lbs.	1,544,000 lbs.	7,561,000 lbs.
Unit harvest cost:	x $0.43	x $1.12	$ x $1.12	-
Total:	$ 1,604,000	$ 2,560,000	$ 1,729,000	$ 5,893,000
With-project gross return, year 2:	$ 5,970,000	$ 3,658,000	$ 2,470,000	$12,098,000
Less harvest cost:	-1,604,000	-2,560,000	-1,729,000	-5,893,000
With-project net return, year 2:	$ 4,366,000	$ 1,098,000	$ 741,000	$ 6,205,000
Year 2 increase in net return:	$ 2,575,000	0	0	$ 2,575,000
With-project harvest years 12-50:	5,651,000 lbs.	5,878,000 lbs.	3,062,000 lbs.	14,591,000 lbs.
Unit harvest cost:	x $0.43	x $1.12	$1.12	-
Total:	$ 2,430,000	$ 6,583,000	$ 3,429,000	$12,442,000
With-project gross returns, years 12-50:	$ 9,042,000	$ 9,405,000	$ 4,899,000	$23,346,000
Less harvest cost:	-2,430,000	-6,583,000	-3,429,000	-12,442,000
With-project net return, years 12-50:	$ 6,612,000	$ 2,822,000	$ 1,470,000	$10,904,000
Years 12-50 increase in net returns:	$ 4,821,000	$ 1,724,000	$ 729,000	$ 7,274,000

1/ @ $1.60/lb.

TABLE F-2-10

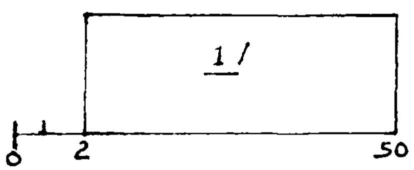
SCENARIO I - DREDGED HARVEST

Benefit Summary
(1983 Prices)

	Louisiana Leased	Louisiana Public	Mississippi Public	Total
Without-project harvest:	3,731,000 lbs.	2,286,000 lbs.	1,544,000 lbs.	7,561,000 lbs.
Unit harvest cost:	$1.12	$1.12	$1.12	$1.12
Total:	$4,179,000	$2,560,000	$1,729,000	$8,468,000
With-project harvest 2/:	3,731,000 lbs.	2,286,000 lbs.	1,544,000 lbs.	7,561,000 lbs.
Unit harvest cost:	$0.43	$0.43	$0.43	$0.43
Total:	$1,604,000	$ 983,000	$ 664,000	$3,251,000

Reduction in cost, years 2-50: $8,468,000 - 3,251,000 = $5,217,000

Average Annual Value:
$ 5,217,000



1/		
Value, years 2-50:		$5,217,000
PVA 1/yr, 48 yrs, 8 1/8%:	x	12.0181
PV1, 2 yrs hence, 8 1/8%:	x	.85536
I&G, 50 yrs, 8 1/8%:	x	.08292
Avg. Annual Value:		$4,447,000

Source: US Army Engineer District, New Orleans District

2/ Applies only to years 2-50 of the project life.

SCENARIO I

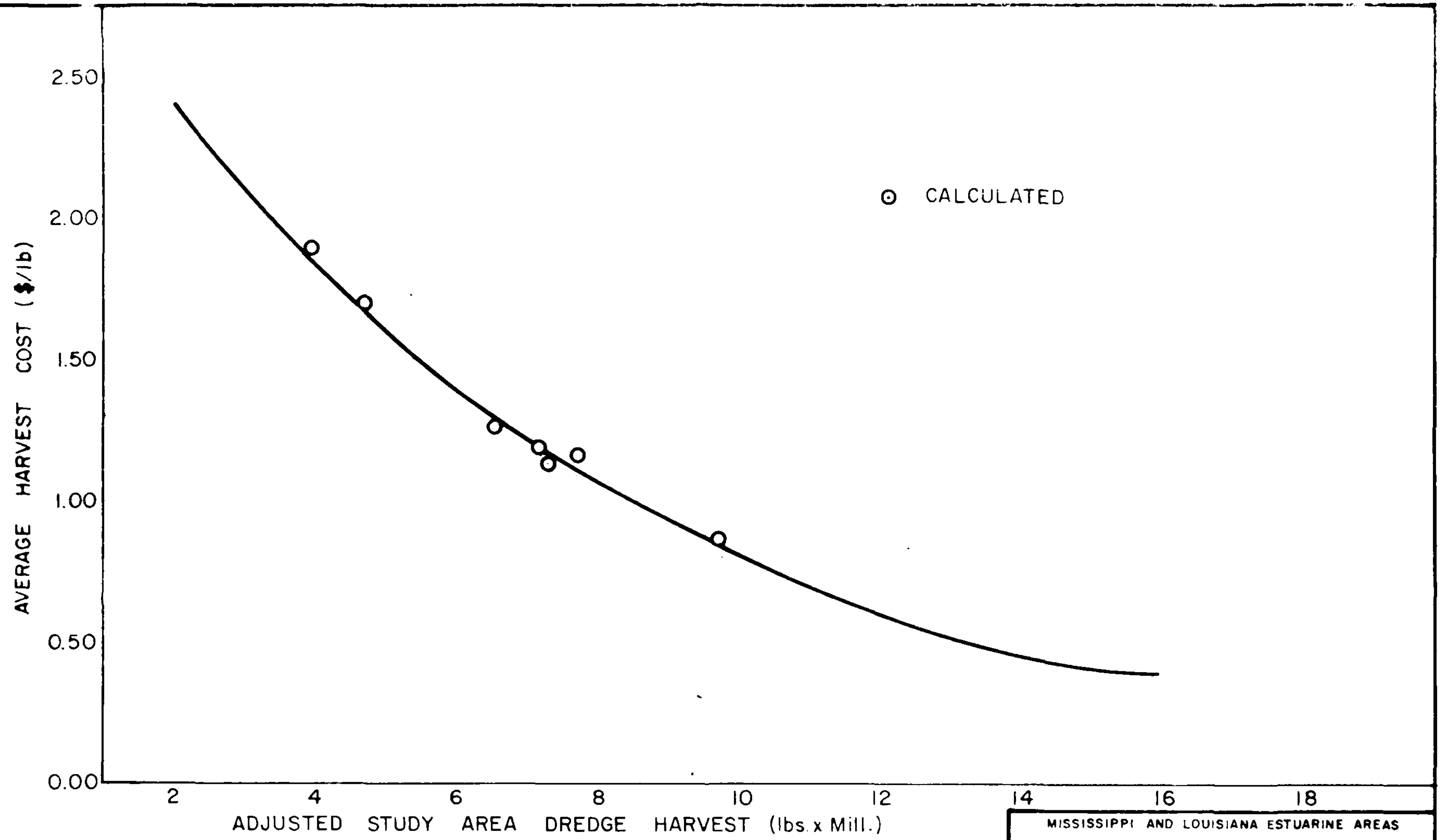
F.2.24. Table F-2-10 summarizes the NED benefits corresponding to this scenario in which no growth in demand above base year (1990) harvest is projected. Aggregate harvest cost based on total landings by dredge of \$1.12/lb. in the without-project condition is compared to a 62 percent reduction in cost in the with-project conditions. This savings of \$0.69/lb is applicable to project years 2 through 50 and generates an average annual savings in harvest cost of \$4,447,000.

SCENARIO II

F.2.25. As shown in table F-2-11, net returns on leased bottoms increase over a 10-year period (1992-2002) as a function of both reduced harvest cost and increased landings, then remain constant for the rest of the project life. On Louisiana and Mississippi public areas, this scenario assumes that the steadily increasing catches will attract additional competitors for the resource. Therefore, unit harvest costs remain about the same as pre-project values although net returns increase due to the greater catch. Under this scenario, average annual benefits of \$5,058,000 are attributable to the NED account.

SCENARIO III

F.2.26. The third scenario is based on the same projected increase in demand at the national level as Scenario II. In Scenario III, however, the entire increase in study area output is immediately taken off the market. Thus, both public and private oyster bottoms are initially equally profitable. Based on the assumption that no restrictions to entry would be enacted by governmental bodies, public oyster bottoms are then projected to experience a dissipation of harvest cost savings as excess capital and operators are attracted to the fishery. Over 10



MISSISSIPPI AND LOUISIANA ESTUARINE AREAS

SHORT-RUN
AVERAGE HARVEST COST (DREDGE)
1970-1976

US ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
APRIL 1984 FILE NO.

FIGURE F-8

FIGURE F-8

TABLE F-2-9

UNIT HARVEST COST ESTIMATE
STUDY AREA OYSTER DREDGES

1983 Prices

Year	Licensed Vessels [1]	Total Cost @ $50,000/ea.	Study Area Harvest (lbs)	Cost/lb
1970	166	$8,300,000	7,279,000	$1.17
1971	169	8,450,000	7,171,000	1.18
1972	179	8,950,000	7,698,000	1.16
1973	165	8,250,000	6,514,000	1.27
1974	149	7,450,000	3,940,000	1.89
1975	158	7,900,000	4,646,000	1.70
1976	167	8,350,000	9,756,000	0.86

Exponential Curve Fit: $\ln y = \ln b + mx$ (See figure 8)

Intercept = 2.9995 Slope = −0.00013687 r = −0.99

x	y	x'	y'
7279	1.14	1,000	2.78
7171	1.18	2,000	2.42
7698	1.16	3,000	2.11
6514	1.27	4,000	1.83
3940	1.89	5,000	1.60
4646	1.70	6,000	1.40
9756	0.86	7,000	1.22
		8,000	1.06
		9,000	0.93
		10,000	0.80
		11,000	0.70
		12,000	0.61
		13,000	0.54
		14,000	0.47
		15,000	0.40
		16,000	0.36

Source: US Army Corps of Engineers, New Orleans District

[1] Pro rata distribution of licensed oyster dredge vessels in both states based on percentage of bottoms within study area.

TABLE F-2-8

OYSTER DREDGE BOAT ANNUAL COST ESTIMATE

1983 Prices

1. Boat Cost: 30'-50', wood hull 1/	
New cost	$80,000
Annual Charges	
Interest and Amortization, 10 years, 8 1/8%	12,000
Insurance	1,800
Drydock	1,100
Repairs, maintenance	4,400
	$19,300
2. Variable cost	
Fuel (9 months, 5 days/wk, 4 hrs/day = 720 hrs x 3 gal./hr x $1.30/gal.):	$ 2,800
Crew wages (1@ $11,000; 1 @ $16,000) 2/	27,000
Food, ice, supplies (180 days x 2 men x $8.00/man)	2,900
	$32,700
Subtotal:	$52,000
3. Salvage Value of Boat 1/	
Less: $80,000 x 35% salvage value x PV1 10 yrs hence x I&A, 10 years @ 8 1/8% =	$1,900
Total:	$50,100 ($50,000)

Source: US Army Corps of Engineers, New Orleans District

1/ Estimate based on data contained in "Costs and Return Trends in the 1970's for Gulf of Mexico Vessels," John P. Warren and Wade L. Griffin. Prepared for presentation at the Aquatic Credit School, Jacksonville, Florida, July 1978. Price levels expressed in 1982 dollars using the ENR Index.

2/ Includes return to management.

TABLE F-2-7

WITH-PROJECT POTENTIAL OYSTER HARVEST BY DREDGE

(lbs x 1000)

	Louisiana 3/		Mississippi 3/		Total Study Area		
	Leased	Public	Leased	Public	Leased	Public	Total
Base period 1/	3,731	2,286	0	1,544	3,731	3,830	7,561
With-project total potential 2/	5,766	5,998	0	3,735	5,766	9,733	15,499
Percent dredged	98%	98%	-	82%	-	-	-
With-project potential dredged	5,651	5,878	0	3,062	5,651	8,940	14,591

Source: US Army Corps of Engineers, New Orleans District

1/ Louisiana 1970-76; Mississippi 1967-82

2/ Appendix D

3/ Based on "Fishery Statistics of the U.S." 62% of Louisiana oyster bottoms are leased; 100% of Mississippi bottoms are public.

Identifying and characterizing the activities in this way focused on the actual impacts and the manner in which changing conditions could be quantified.

F.3.6. Although the public pursues many recreational activities in this region, freshwater diversion is expected to directly affect two primary activities, hunting and fishing. Nonconsumptive water-based general recreation type activities do not necessarily depend on saline levels or marsh preservation. Private hunting leases are extensive, but generally exclude use by nonmembers. Private camps are numerous and serve as support facilities for the hunting and fishing that are the major attractions of the area. The basic recreation activities measured in the demand-need analysis are:

- Freshwater fishing
- Saltwater fishing
- Big game hunting
- Small game hunting
- Migratory bird hunting
- Waterfowl hunting

In addition to these consumptive uses, one nonconsumptive use, picnicking, was measured. The reason for including picnicking is that boat launch areas provided as a result of a need indicator would include a small number of picnic tables adjacent to the launch as part of the boat access development.

NED BENEFITS

F.3.7. Table F-3-1 displays the decade values of recreation resources with- and without-project. The recommended plan will generate or preserve recreational opportunities that are valued at $673,000 in 1990, and that increase to $690,000 by 2040, the end of project economic

TABLE F-3-1

TOTAL RECREATION USE AND VALUE

Mississippi and Louisiana Estuarine Areas

Activity	Man-days Without Project	Dollar Value Without Project	Man-days With Project	Dollar Value With Project
		1990		
Hunting	270,973	2,196,902	270,973	2,196,902
Fishing	1,822,000	7,656,000	1,931,000	8,111,000
Picnicking	5,109,700	19,417,000	5,151,000	19,575,000
TOTAL	7,203,473	29,269,902	7,353,473	29,882,902
		2000		
Hunting	247,598	2,028,607	250,548	2,053,564
Fishing	1,822,800	7,656,000	1,931,100	8,111,000
Picnicking	5,109,700	19,417,000	5,151,400	19,575,000
TOTAL	7,180,098	29,101,607	7,333,048	29,739,564
		2010		
Hunting	226,572	1,875,672	231,594	1,915,534
Fishing	1,822,800	7,656,000	1,931,100	8,111,000
Picnicking	5,109,700	19,417,000	5,151,400	19,575,000
TOTAL	6,955,152	28,948,672	7,314,094	29,601,534
		2020		
Hunting	207,630	1,736,448	214,521	1,783,088
Fishing	1,822,800	7,656,000	1,931,100	8,111,000
Picnicking	5,109,700	19,417,000	5,151,400	19,575,000
TOTAL	7,140,130	28,809,448	7,297,021	29,469,088
		2030		
Hunting	190,506	1,609,113	199,120	1,675,332
Fishing	1,822,800	7,656,000	1,931,100	8,111,000
Picnicking	5,109,700	19,417,000	5,151,400	19,575,000
TOTAL	7,123,006	28,682,113	7,281,620	29,361,332
		2040		
Hunting	175,121	1,493,723	185,209	1,570,733
Fishing	1,822,800	7,656,000	1,931,000	8,111,000
Picnicking	5,109,700	19,417,000	5,151,400	19,575,000
TOTAL	7,107,621	28,566,723	7,267,709	29,256,733

Source: US Army Corps of Engineers, New Orleans District

life. The average annual value of this benefit stream amounts to $638,000 when discounted at the current discount rate of 8 1/8 percent.

Section 4. SUMMARY OF ANNUAL BENEFITS

	Annual Benefits[1/]		
	Commerical Fishing	Recreation	Total
Scenario I	$4,502,000	$638,000	$5,140,000
Scenario II	$5,448,000	$638,000	$6,086,000
Scenario III	$8,557,000	$638,000	$9,215,000

1/ Oct 1983 price levels, 8 1/8 percent discount rate, 1990 base year.

Section 5. FIRST COSTS, ANNUAL CHARGES, AND BENEFIT-COST RATIOS

F.5.1. First costs and annual charges for the recommended plan are shown in table F-5-1. All values are stated at October 1983 price levels. Net investment is based on a two-year construction period beginning in 1988. Operation, maintenance, and replacement (OM&R) investments have been annualized using present-worth methods and the intervals indicated on the table. Annual expenditures are assumed to occur at mid-year. The project base year is 1990. The discount rate used for net investment, OM&R, and interest and amortization calculations is 8 1/8 percent.

F.5.2. Project annual benefits, annual charges, benefit-cost ratios, and excess benefits over costs for each scenario are shown in table F-5-2.

F.5.3. Most Probable Future. As discussed in Section 2, uncertainty concerning the most probable future values of the major variables described in this section prevented the selection of a single "most probable future." For that reason, multiple scenario analysis was chosen. The feasibility curve shown on figure F-9 suggests the likelihood of various future outcomes. As shown on the figure, the most conservative set of assumptions (Scenario I) produces benefits that fall very slightly below feasibility (benefit/cost = 0.86). Scenario II lies slightly above the feasibility limit (benefit/cost = 1.02), while Scenario III is comfortably justified, having a benefit/cost of 1.6. The "firmness" of these end points (Scenarios I and III) is also germane. Scenario I is considered to have closely captured the minimum value. As discussed in Section 6, significant potential benefits beyond those estimated under Scenario III could exist, however.

TABLE F-5-1

FIRST COST AND ANNUAL CHARGES

(1983 Prices)

1. First Cost:	
a. Site first cost (2 years)	$52,172,000
b. Pre-construction monitoring (3 years):	2,156,000
c. Post-construction monitoring (4 years):	2,860,000
d. Recreation sites remote from structure (2 years):	626,000
Total:	$57,814,000
2. Net Investment:	
Present value of first cost at base year 1990:	$ 62,000,000
3. Interest and Amortization @ 8 1/8% (.08292):	$ 5,141,000
4. Operation, Maintenance, and Replacements:	
Annual cost for indicated interval or duration:	
a. Long-term biological and water quality monitoring (46 years):	$ 120,000
b. Dredging of sedimentation trap (50 years):	583,000
c. Major maintenance of structure (every 15 years):	250,000
d. Operation and routine maintenance of structure (50 years):	700
e. OM&R, recreation sites (50 years):	14,000
f. Long-term hydrologic monitoring program:	see Appendix K
Net investment, items a-e.:	$ 698,000
Net investment, item f:	124,000
Total OM&R:	$ 822,000
5. Total Annual Charge; items 3 & 4:	$ 5,963,000

Source: US Army Corps of Engineers, New Orleans District

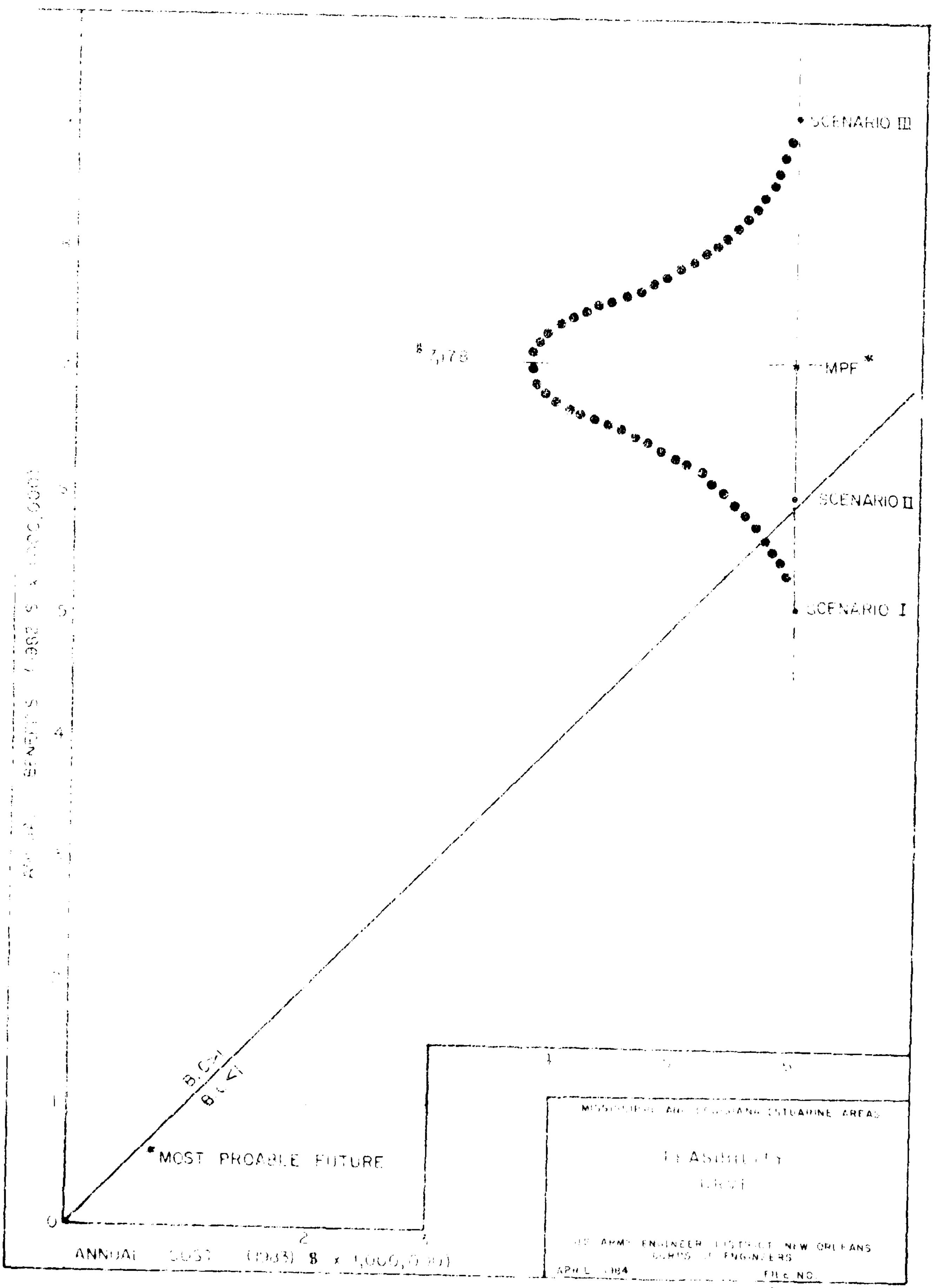
TABLE F-5-2

BENEFIT-COST RATIOS

(1000's of 1983 dollars)

	Annual Benefits	Annual Costs	Excess Benefits	Benefit-Cost Ratio
Scenario I:	$5,140	$5,963	$823	0.86
Scenario II:	$6,086	$5,963	$123	1.02
Scenario III:	$9,215	$5,963	$3,252	1.6

F.5.4. Assuming an effective normal distribution of all study variables, one could expect the most likely benefit/cost value to fall near the midpoint of the feasibility curve (figure F-9), or about 1.20:1, based on benefits of $7,178,000 and annual charges of $5,963,000.


SCENARIO III
MPF *
SCENARIO II
SCENARIO I
B.C>1
B.C<1
MOST PROBABLE FUTURE
ANNUAL COST (1983) $ x 1,000,000
0
1
2
3
4
5
MISSISSIPPI AND LOUISIANA ESTUARINE AREAS
FEASIBILITY
U.S. ARMY ENGINEER DISTRICT NEW ORLEANS
CORPS OF ENGINEERS
APRIL 1984
FILE NO.
FIGURE F-9

Section 6. SENSITIVITY ANALYSIS

F.6.1. In this section, the major study variables and the effects of changes in the values of those variables on project justification are identified.

DATA

F.6.2. The first area of concern to the analyst is the fundamental reliability of base data that require adjustments of as much as 150 percent, as in the case of landings poundages. This concern is particularly acute because the proportion of national output represented by the adjusted study area data is quite large. Since the ultimate output of project area reefs is determined by a theoretical maximum potential and the gap between existing observed output and that theoretical maximum makes up the beneficial output, unreported landings not accounted for by the adjustment factor would tend to reduce annual benefits. The adjustment factor used for project area reefs in this study is based on considerable study and includes input from involved government agencies. The factor is regarded as the most reliable currently available.

F.6.3. Another data problem is the rapidly increasing variability as national landings are disaggregated to the project area level. While fairly good time series correlation (r = 0.9) is observed for national and gulf-wide unadjusted landings, correlation at the study area level is heavily influenced by one or two good or bad years. In fact, the sign of "r" can change from negative to positive in some instances as given years are included or excluded. This problem is compounded by the short period for which historical data (1970-1976) disaggregated at study area level were available. Fortunately, the period of record can be about doubled in later studies since more publications are continuously being obtained. For the present, however, trend line (time

series) analysis appears to be an adequate method of addressing output over time.

VESSEL COSTS

F.6.4. Vessel costs were constructed from an extensive body of information on similar size vessels used in the shrimp fishery and adjusted for differences in deck equipment. As a result, a reasonable degree of confidence can be attached to the value used. The accuracy of the estimated portion of the short-run average unit harvest cost curve (figure F-8) which lies well outside the range of values based on observations of catch and number of vessels licensed is more uncertain. The shape of this curve directly influences the magnitude of cost savings and benefits in all three scenarios. Beyond the high statistical correlation of the data used to derive the curve (r = -0.99), one can intuitively appreciate the opportunity for average unit savings of this magnitude in a fishery that is in general decline. Idle capacity in the form of unused or underutilized vessels created a situation in which considerable increases in catch can be achieved at little or no increase in total operating cost if the resource becomes available.

PER CAPITA CONSUMPTION (PCC)

F.6.5. The long-term decline in PCC of oysters is well-documented if not completely understood. Certainly many of the major causes are suggested in the NMFS study described in Section 2. In addition to pollution-related reef closures, public perceptions of pollution in or near the study area fishery also contribute to the problem in a significant way. Scenarios II and III are based on, but not totally dependent on, a reversal of this trend through pollution abatement programs, marketing initiatives within the industry, changed policies and regulations, and other salutary efforts outlined in Section 2. If

national trends do not turn around, however, sales of project-induced production can still take place at the same or possibly slightly slower rate, in effect merely offsetting increasing losses in the Chesapeake fishery. A greater marketing effort would simply be required.

RATE OF SALES INCREASE

F.6.6. Scenario II is based on the passage of a 10-year period in order to fully market the increased study area average annual output. A 10-year period may not be necessary and a shorter period of time may be the more likely case. If so, benefits under Scenario II are somewhat understated due to the effect of the 8 1/8 percent discount rate on future benefits.

UNQUANTIFIED BENEFITS TO COMMERCIAL FISH SPECIES

F.6.7. As shown on table F-6-1, a significant commercial fishery exists in the study area over and above the oyster fishery. Since there is no easily developed mechanism to relate project outputs to the vitality of this fishery, no benefits were quantified. This is not to say that such benefits don't exist. They clearly do and, if they were quantifiable, they would probably result in enough additional benefits under Scenario I to exceed a 1:1 benefit-cost ratio. Additional information concerning qualitative benefits to other fishery resources can be found in the Environmental Impact Statement (EIS).

ADVERSE EFFECTS

F.6.8. No attempt was made to economically quantify the effect of project operation on the commercial and recreational shrimp fishery in Lake Pontchartrain. Biological aspects of this issue are discussed in the EIS.

TABLE F-6-1

STUDY AREA COMMERCIAL HARVEST BY SPECIES[1/]

Species	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
					(Thousands of Lbs)					
Oysters [2/]	10,042	7,421	7,336	8,765	6,737	4,038	4,758	10,202	10,345	10,562
Shrimp [2/]	41,586	36,522	40,719	29,454	14,604	17,289	17,739	26,181	31,950	21,141
Menhaden	50,000	57,000	104,000	35,000	50,000	4,000	-	49,000	88,000	126,000
Crab	2,515	3,284	2,803	2,964	3,860	2,178	1,775	2,263	2,794	2,485
Seatrout	312	640	767	681	873	458	1,045	654	349	251
Croaker	1,851	2,730	3,479	3,600	4,801	3,949	3,738	2,396	1,193	707
Red Drum	210	191	99	79	125	115	83	105	221	87
Spot	10	15	31	37	67	33	11	7	2	3
Unclassified industrial species	-	-	30,000	26,000	51,000	43,000	45,000	25,000	40,000	36,000

Source: US Army Corps of Engineers, New Orleans District

1/ Source: National Marine Fisheries Service
2/ Adjusted tor estimates of unreported landings

PRICE EFFECTS

F.6.9. No market price effect was considered applicable to the three scenarios analyzed in this study. Under Scenario I, no increase in average sales was claimed, thus, price effect was not an issue. Under Scenarios II and III, the increased output takes place in a setting that features increasing national demand. Even if such demand does not develop, continued decline in the Chesapeake Bay fishery would create a market for project area reef output. Large portions of the gulf harvest now, in fact, are shipped to Atlantic coast markets previously served by the faltering Chesapeake Bay fishery.

OTHER SCENARIOS

F.6.10. The three scenarios described in Section 2 are based on the assumption that state authorities will make no fundamental changes in the regulation and operation of the fishery. One consequence of this assumption is that there would be about the same ratio of leased and public oyster bottoms with- and without-project. Another consequence is that regulatory barriers to entry in the public fishery have not been considered in the analysis. Since these are matters of local prerogative, this approach seemed appropriate. If, on the other hand, the states' goals shift towards maximum efficiency and productivity at the expense of some employment opportunities, this analysis suggests that limited entry to the fishery and greater use of leasing would result in about the same total oyster meat output at a considerably lowered aggregated capital investment. The NED benefits under this type of scenario would be much greater than those under the three scenarios analyzed in the study.

[illegible]ATIONSHIP TO THE LOUISIANA COASTAL AREA PROJECT

[illegible].6.11. Linked to the issues of price effects and aggregate national [illegible]emand is the relationship between the increased oyster output projected [illegible]o occur with implementation of this project and similar increases in [illegible]utput projected to occur in nearby estuaries as a result of the [illegible]reshwater diversions which are featured in the Louisiana Coastal Area, [illegible]tudy. Due to information and time constraints which prevailed for that [illegible]arlier study, as well as a poorer understanding of the nature of the [illegible]yster industry (particularly the historically higher PCC of oyster [illegible]eat), it was assumed that no substantial increases in output could be [illegible]arketed except at reduced prices. This assumption is significantly [illegible]lawed in that it is based on a static appraisal of the national market, [illegible]hereas the time series analysis included in Section 2 of this study [illegible]ndicates that growth in the study area harvest could serve primarily to [illegible]ffset continued decline in the remainder of the national fishery. [illegible]urthermore, under scenarios which include increased national demand [illegible]eyond the increases discussed herein, the project-induced output from [illegible]oth study areas could be taken off the market at no significant price [illegible]eduction. As to the ultimate marketability of the combined project [illegible]utputs if greater national demand does not develop, the significantly [illegible]reater efficiency of the local fishery implied on Figure F-5 would [illegible]uggest that by implementing modestly aggressive pricing strategies, the [illegible]tudy area harvesters could claim a substantially greater share of the [illegible]ational market. The net NED effects of such competition for market [illegible]hare would probably only slightly lessen the benefits claimed for the [illegible]roject.

AD-A152 725 MISSISSIPPI AND LOUISIANA ESTUARINE AREAS FRESHWATER DIVERSION TO LAKE PO..(U) ARMY ENGINEER DISTRICT NEW ORLEANS LA D L CHEW APR 84 2/6

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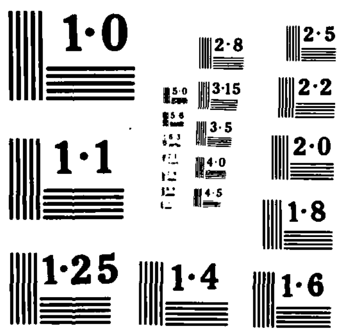
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Section 7. UNQUANTIFIED BENEFITS

F.7.1. In Section 6, the unquantified benefits to commercial species other than oysters were briefly discussed. In addition, other beneficial project effects that pertain to the oyster fishery in general can be identified, even if not quantified, in a manner suitable for inclusion as benefits to the NED account.

F.7.2. First among the beneficial effects was greater employment opportunities afforded fishermen directly and indirectly to associated workers in the processing and sales segments of the industry. At least 500 fishermen are engaged in the study area oyster fishery. For each of these jobs, approximately three or four other jobs are created as the catch was processed and sold.[6]

F.7.3. Another employment aspect of considerable local interest is related to processing operations. Due to the high annual variability of the local catch, a great deal of the harvest is shipped to existing processors in the declining Chesapeake Bay fishery area rather than risk new investment in local facilities. Enhancing and stabilizing the study area fishery would increase the attractiveness of such investments locally and create substantial job opportunities within the region. In fact, Biloxi, Mississippi, was second only to Baltimore as the largest oyster processing center in the US in the early part of this century.

F.7.4. Preservation and enhancement of Federal, state, and local tax bases also can be attributed to project effects. Many of the operators

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[6] Source: "Economic Impacts of the US Commercial Fishing Industry." Centaur Management Consultants, Inc., prepared for the National Marine Fisheries Service, Jan. [illegible], pp. [illegible].

Section 8. SOCIOECONOMIC IMPACT ASSESSMENT

SUMMARY

F.8.1. The table below summarizes the social and economic project impacts required to be identified and evaluated under Public Law 91-611, Section 122.

TABLE F-8-1

SUMMARY OF SOCIOECONOMIC IMPACTS

	Future Without-Project Conditions	Future With-Project Conditions
ECONOMIC IMPACTS		
1. Business and Industry	—	+
2. Employment/Labor Force	—	+
3. Land Use	N	-, +
4. Property Values	-	+
5. Public Facilities and Services	N	+
6. Tax Revenues	+, -	+
7. Energy	N	N
8. Displacement of Farms	N	N
9. Regional Growth	-	+
SOCIAL IMPACTS		
10. Displacement of Pepole	-, +	+, —
11. Housing	N	—
12. Community Growth	+ —	+, —
13. Noise	N	N
14. Esthetics	N	N
15. Community Cohesion	+ —	+ —

KEY: (+) - positive; (-) - negative; (-)(+) - both positive and negative; N - negligible

OYSTERS AND INDUSTRY

F.8.2. In New Orleans and along the Mississippi Gulf coast, port activities, mineral production, tourism, and construction have formed the primary economic base. The seafood industry is, nevertheless, very important. The industry is significant to the local culture, and tourist industries have heavily promoted the abundance and variety of seafoods.

F.8.3. Louisiana State University is studying problems of the state's declining oyster fishery including effects of "the gradual encroachment of saltwater into prime oyster grounds" ("Aquanotes" Mar. 1983). Among the areas affected by this problem are Mississippi Sound and Chandeleur Sound, within the study area. The Mississippi Marine Conservation Commission and its predecessor, the Mississippi Seafood Commission, have also conducted surveys to evaluate such problems and help revive Mississippi's ailing oyster industry ("Marine Brief", Feb. 1978).

F.8.4. Another report, prepared by the NMFS also points out national problems and issues involved in a declining oyster industry ("A Comprehensive Review of the Commercial Oyster Industries in the United States," Mar. 1977). These issues and problems were already detailed in Section 2 of this Appendix.

F.8.5. Historically, oyster harvests in the vicinity of the study area have fluctuated dramatically. For example, from the late 1800's to 1930, oyster landings in Mississippi averaged about 265,000 barrels. The average barrel holds from 25 to 27 pounds of oyster meat. During World War II, 1941-1945, oyster reefs were unregulated and overfished, which made them permanently less productive (Marine Fisheries Review Paper 1259, Aug. 1977). From 1940 to 1960, landings averaged 32,000 barrels. During the 1960s, however, landings increased to an average

annual volume of 160,000 barrels with a value at that time of $1.5 million. Following Hurricane Camille in 1969 and a major flood in 1973, however, water quality deteriorated and landings again declined to 15,000 barrels by 1974 (ibid. 1977).

F.8.6. Without construction of the proposed project, growth of the oyster industry within the study area would remain at substantially lower levels than with the project. Improved control of salinity levels in Lake Borgne, Chandeleur Sound, and Mississippi Sound would generate dramatic increases in oyster production. Better control of these resources would add stability to the entire industry, from oyster fishermen to wholesale and retail markets, and to restaurants and oyster bars.

F.8.7. The additional fresh water into Lakes Pontchartrain and Borgne during periods of unusally high salinity would tend to encourage certain other fish and shellfish less tolerant of low salinities such as brown shrimp, spotted seatrout, and red drum to move eastward toward Lake Borgne and Chandeleur Sound. Other resources such as blue crab, Atlantic croaker, menhaden, and white shrimp are not expected to be greatly affected by the additional fresh water diverted from the river into the lakes.

EMPLOYMENT/LABOR FORCE

F.8.8. Oyster production in Chandeleur and Mississippi Sounds represents an important source of employment within the area's seafood industry. The comprehensive review of the nation's oyster industry prepared by the US Department of Commerce indicated that in the mid-1970s about 3,000 people were employed in the harvest of oysters in the Gulf of Mexico region, approximately 28 percent of the total 11,700 reported for the nation. An additional 1,900 were employed in the oyster processing industries of the gulf coast. An unknown number of jobs are created by

the demand for freshly opened raw oysters at oyster bars and restaurants. Fresh raw oysters are available year-round in New Orleans.

F.8.9. Employment in the gulf coast oyster industry has been unpredictable. The availability of oysters has fluctuated greatly because of changes in salinity levels, pollution, and natural disasters such as floods and hurricanes. The industry is labor-intensive and depends on workers who can withstand the effects of cyclical employment or who are prepared for alternative employment from season to season because of poor harvests. Historically, much of the work does not require formal education and technical training and incomes are generally below average.

F.8.10. If no action is taken, employment difficulties can be expected to continue. If salinity levels in the vicinity of the study area are optimized, however, one of the major problems facing the oyster industry would be controlled. The employment of oyster fishermen, oyster processors, and those involved in product marketing would become more stable. As production increases, the potential for additional employment would also increase. On the other hand, fresh water introduced into the Lake Pontchartrain Basin could require shrimpers and other commercial fishermen to move toward Lake Borgne and Chandeleur Sounds, following species which would tend to move toward more saline waters.

LAND USE

F.8.11. Fish and shellfish landed in the study area have influenced land use patterns through the development of harbors, recreation facilities, and the area's seafood industries. The availability of fresh seafood at modest prices has also influenced the expansion of tourism and the growth of restaurants and hotels in New Orleans and along the Mississippi Gulf Coast. Other economic influences, however, including

increasing technology, the decline of agriculture as a primary source of employment, expansion of mineral production and port facilities, and urban population growth, are more significant factors influencing land use trends in the area. If the proposed project is not constructed, current land use trends would probably continue largely unchanged, although the utility of lands related to the fishery could be impaired. Construction of the project would prevent this eventuality and possibly foster some expansion of existing fishery related facilities.

F.8.12. If the project is constructed as originally designed, the primary adverse impacts to land use would affect the community located immediately upriver from the spillway structure. The total amount of land required for the project includes portions of the existing Bonnet Carre' spillway rights-of-way as well as 61.2 acres of adjacent, privately owned land adjacent to the rights-of-way. Of this additional land, 17.6 acres are currently used for residential purposes and the remaining 43.6 acres have potential for residential use. Land adjacent to the rights-of-way might be considered less desirable for development due to noise during project construction and close proximity to the revised highway rights-of-way. The recommended plan has been modified to include relocation of residents of Montz between the spillway structure and the power plant. This would increase the total amount of land required from the project outside the spillway to 77.2 acres.

PROPERTY VALUES

F.8.13. If no effort is made to stabilize the problems of the oyster industry, the value of some capital investments made to establish and keep the industry productive could be adversely affected. For example, the value of processing equipment could decline. If construction of the project results in an overall increase in the total value of seafood production in the study area, the value of the land and equipment needed for the industry's stability and growth would increase.

PUBLIC FACILITIES AND SERVICES

F.8.14. At the present time, the primary public facilities and services influencing the oyster industry are government-operated waterways and navigational aids, public regulation for resource conservation and pollution control, and publicly funded studies to promote its development. In addition, the project is designed to use a portion of the existing Bonnet Carre' floodway, adding to the utility of existing public facilities. No other significant impacts under this category are anticipated.

TAX REVENUES

F.8.15. The tax revenues generated by oyster production have not been great relative to those generated by other resource development such as mineral production. A decline in oyster industry general activities, property values, and the personal taxes of those working in the industry could have adverse impacts on the tax bases of small communities within the study area where oyster landings are important to the local economy. Continued instability within the oyster market could also have an adverse impact on revenues collected from tourist industries, oyster bars, and restaurants. A minor loss of tax revenues may result from displaced housing at the project structure site.

F.8.16. If the net effect of the proposed project includes a substantial increase in oyster production, the economies and the tax base of the fishing villages scattered throughout the study area would be improved. Additional processing plants could also generate additional tax revenues.

ENERGY

F.8.17. The instability of the oyster industry has resulted in inefficiencies of scale. While many of these inefficiencies have not been measured in this study, the underutilization of vessels and facilities results in waste of energy used in operation. If improved control of salinity levels in the study area has the effect of attracting more investment into the oyster industry, the potential for improved efficiencies could include reduced average energy costs.

DISPLACEMENT OF FARMS

F.8.18. Neither the with- or without-project condition would have any significant impact on the displacement of farms.

REGIONAL GROWTH

F.8.19. Since commercial and sport fishing is important to the study area economic growth and recreation, any enhancement of fishery resources, including oysters, would have a beneficial impact on the region's future growth.

DISPLACEMENT OF PEOPLE

F.8.20. The economic growth in the area is expected to continue with or without the project. Consequently, the total population is also expected to increase. However, if no efforts are made to protect and develop the oyster industry, the effects of pollution and uncontrolled salinity levels could continue to reduce employment in the industry and displace those working in the harvest, processing, transportation,and marketing of oysters and related products. Some would be forced to seek employment elsewhere. If the project is successful in expanding the

oyster industry without significantly affecting other elements of the commercial seafood industry and sport fishing activities, the resultant economic stimulus could have a minor stabilizing effect on population trends, particularly in area fishing villages.

F.8.21. Construction of the originally proposed project would have required the permanent relocation of a number of people living within the project rights-of-way. The proposed rights-of-way would have required the taking of an estimated 26 permanent residential structures and outbuildings and six mobile homes. All residences are single-family dwellings. The St. Charles Parish Police jury passed a resolution dated December 19, 1983, supporting the project and requesting that the Corps of Engineers purchase the entire community of Montz bounded by the Bonnet Carre' Spillway, River Road, Louisiana Power and Light Little Gypsy power plant, and the Illinois Central Gulf Railroad. Modification of the plan as requested by St. Charles Parish would require relocation of 52 single family dwellings, 16 trailers, and 1 church. Montz is a predominantly low-income community and most of the residents are closely related. The community has a strong sense of cohesiveness. Several residents of the community have indicated that three and four generations of their families live in Montz and they have no desire to live apart. At the Corps public meeting in Destrehan, Louisiana, on Deember 6, 1983, the councilman representing the community presented a petition signed by 24 residents requesting that the community be relocated as a unit. The New Orleans District of the Corps of Engineers concurs with the request and the recommended plan has been revised accordingly.

HOUSING

F.8.22. Housing demands in the area are expected to follow the general economic trends of growth and normal fluctuations. Industrial develop-

ment, population growth, the declining availability of protected land on the east bank, and the eventual completion of the Mississippi River bridge at Luling, Louisiana, are expected to keep the housing market in St. Charles Parish particularly active. Being located between the spillway levees and a large electrical generating station somewhat limits the potential of project rights-of-way lands for future residential development. However, future demand for housing in the parish and limited availability of protected land elsewhere will increase pressures to develop vacant land for residential purposes.

F.8.23. The current Bonnet Carre' plan would require the taking of approximately 69 dwelling units. While this would result in considerable inconvenience for the people required to move and a minor reduction in housing availability in St. Charles Parish, the net impact on housing in the study area would be minor.

NOISE

F.8.24. Construction associated with the spillway modification and the levee and highway realinement would cause a temporary increase in noise levels in the immediate vicinity of the spillway. Compliance with all Federal regulations regarding noise abatement would be required. The current highway and levee would be moved closer to the power plant. However, once construction of the project is complete, noise impacts overall would be minor.

ESTHETIC VALUES

F.8.25. The only significant esthetic values that might be affected by the project would be those in the immediate vicinity of the proposed construction site. The relatively low density levels and close proxim-

... to undeveloped areas within the floodway may be considered esthetic-
lly pleasing to residents living between the floodway and generating
tation. As the population of St. Charles Parish continues to grow,
sities will increase, thus open space provided by the floodway would
ome even more important to local residents. Construction of the
roject also would require relocation of the existing highway, LA 628.

MUNITY GROWTH

.5.26. If the proposed project is not constructed, the anticipated
placements would not be necessary, and growth of the small community
ocated between the spillway levees and generating station would prob-
bly continue. The communities in the study area that depend largely on
ommercial fishing and oyster production, would, however, continue to
xperience the effects of an unstable oyster market from year to year.
f the project is constructed and results in a net increase in the value
f seafood production, the economic stability of communities along the
oast could improve. The reduction in available land between the
odified levees and highway and the generating station would reduce
otential for growth in the adjacent community. Therefore, the
ommunity should be relocated as a unit.

OMMUNITY COHESION

.5.27. While construction of the project would require a number of the
amilies living in the immediate vicinity of the construction site to
elocate, higher oyster production and increased employment potential
nd stability could have a more significant beneficial impact. To the
xtent that construction of the project increases the total value of
eafood in the project area, employment and income, two of the most
ignificant factors influencing overall community cohesion, would be
enefited.

TABLE G-1-1 (Continued)

EXISTING OUTDOOR RECREATIONAL FACILITIES INVENTORY
BY PARISH OR COUNTY

Tangipahoa Parish

Proprietorship/ Facility Name	Boat Launching Lanes	Other Amenities
<u>State Areas</u>		
Joyce Wildlife Management Area		13,659 Hunting Acres
<u>Parish Areas</u>		
Lee's Landing Boat Launch	3	
North Pass Boat Launch	4	
<u>Local Areas</u>		
Public Launch	1	
Public Launch	1	
<u>Commercial Areas</u>		
Ponchatoula Beach	1	Camping, Picnicking, Swimming Beach.
Trand's Boat Landing	1	
Cherokee Beach Campground	1	Multi-use Trails, Picnicking, Camping.
Riverside Marina	1	Grocery, Slips.

TABLE G-1-1 (Continued)

EXISTING OUTDOOR RECREATIONAL FACILITIES INVENTORY
BY PARISH OR COUNTY

St. Tammany Parish

Proprietorship/ Facility Name	Boat Launching Lanes	Other Amenities
<u>Federal Areas</u>		
Pearl River Lock #1	2	
Pearl River Lock #2	2	
<u>State Areas</u>		
Pearl River Wildlife Management Area		26,716 Hunting Acres, Nature Trail
Fountainbleau State Park		2,800 Acres, Beach Camping Trails, Sugar Mill.
Fairview Riverside State Park		98 Acres, Fishing.
St. Tammany Wildlife Refuge		1,300 Acres
West Middle Pearl River Launch	1	
Middle Pearl River Launch	1	
East Middle Pearl River Launch #1	1	
East Middle Pearl River Launch #2	1	
East Pearl River Launch	2	
Crawford Landing	2	
Davis Landing	2	
<u>Parish Areas</u>		
Mandeville Harbor Boat Ramp	1	200' Fishing Pier
Madisonville Recreation Facility	2	
<u>Commercial Areas</u>		
Jerry's Marina	2	Restaurant
Joe Love's Place	1	
Lakeview Inn	1	
Cane Bayou Launch	1	
Kentchin Fishing Camp	1	150' Fishing Pier
Milazz Boat Hoist	1	100' Fishing Pier
Martinsen's Ramp	1	

TABLE G-1-1

EXISTING OUTDOOR RECREATIONAL FACILITIES INVENTORY
BY PARISH OR COUNTY

Orleans Parish

Proprietorship/ Facility Name	Boat Launching Lanes	Other Amenities
Federal Areas		
French Quarter - Jean Lafitte National Historical Park		80 city blocks
Big Oak Island Unit - Jean Lafitte National Historical Park		
State Areas		
Fort Pike State Commemorative Area	1	125 acres
Museum		Scenic Vistas
Fort Macomb State Commemorative Area		
Seabrook Ramps	18	
Local Areas		
Breakwater Park	4	Fishing Pier
Municipal Yacht Harbor	1	Yacht Harbor, Slips, Boat Hoist
Commercial Areas		
Martin's Marina	1	Slips
Chef Harbor		Boat Hoist
Wicke's Marina	1	
Bayou View Marina	1	Boat Hoist, Slips
Boat Harbor Inn	1	Boat Hoist, Slips
Lee's Place	1	Boat Hoist, Slips
Yarbrough's Launch	1	Boat Hoist
Eddie's Boat Launch	1	Slips
Barney's Marina	1	Slips
Lombard's Launch	1	
Mike's Marina	1	
Jeanfreau's	1	

predominately in an urban setting. Existing in this metropolitan area are boat launching facilities, picnic areas, a national hiking trail, open park areas, yacht harbors, marinas, and significant nodes of public/private neighborhood recreational developments with ancillary facilities. Activities at existing facilities include boating, boat and bank fishing, crabbing, shrimping, water skiing, sailing, picnicking, jogging, horseback riding, biking, walking for pleasure, engaging in field sports, sightseeing, and observing wildlife.

G.1.10. The remainder of the study area in Louisiana is characteristically rural. State wildlife management areas, state parks, commercial campgrounds, boat launching facilities, yacht harbors, marinas, natural and scenic streams, and scenic roads exist north, south, and west of the metropolitan New Orleans area. Activities in this rural environment are the same as those in the metropolitan New Orleans urban area but there is an added emphasis on fishing and hunting.

G.1.11. The existing recreation inventory for this study was compiled from information obtained from the Louisiana Department of Culture, Recreation, and Tourism-Division of Outdoor Recreation-Office of Program Development, the Bureau of Outdoor Recreation of the Mississippi Park Commission, the Gulf Regional Planning Commission, and field investigations. The inventory was compiled for all major recreational facilities and activities within the immediate project impact zone that would be affected by the proposed project. As is explained in Sections 2 and 4 of this appendix, the major activities directly affected by the proposed freshwater diversion are fishing and hunting. Recreation facilities such as neighborhood parks and playgrounds that would not be affected by implementation of the project were not measured. The surveyed facilities are cataloged by parish/county, proprietor, and activity and are presented in table G-1-1.

State Wildlife Management Areas, eight State Parks, and two State Commemorative Areas currently exist.

G.1.5. On the Mississippi Gulf Coast, recreation facilities are generally oriented to beach and resort activities. Numerous marinas, yacht harbors, fishing piers, and public swimming and sunbathing beaches characterize the immediate shoreline and waterfront areas. The scenic, 26-mile-long Mississippi Coast Parkway features the world's largest manmade sand beach and has the most direct access to the population center of the nation of any saltwater beach in the country.

G.1.6. The Gulf Islands National Seashore is an asset to recreation in the Biloxi-Gulfport area. These barrier islands are among the few remaining offshore islands in the nation that are suitable for public recreation. The islands sustain heavy recreational use by campers, fishermen, sunbathers, and swimmers.

G.1.7. Most of the recreational activities in the Pascagoula-Moss Point area are Gulf-oriented, such as saltwater fishing and boating.

G.1.8. The total amount of tourism is an unknown factor at this time due to the void of gateway data on out-of-state travel. Existing use is increasing at a rapid rate and substantially affects the overall recreational use of the area. During heavy-use seasons, vehicles with licenses from all 50 states can be observed in the vicinity of beach-oriented recreational activities. Most hotels and motels are booked throughout the entire summer season.

G.1.9. The Louisiana portion of the study area, unlike the urban linear beach and resort communities of the Mississippi Gulf Coast, consists of urban and rural recreational environments. In Metropolitan New Orleans on the south shore of Lake Pontchartrain recreational use occurs

Section 1. EXISTING CONDITIONS

OVERVIEW

G.1.1 The Mississippi and Louisiana Estuarine Areas support a large year-round recreational resource base that offers a variety of popular recreational pursuits.

G.1.2. One of every two persons in the study area is involved in outdoor recreation. With water serving as the largest single attraction, coastal zones are focal points for related outdoor activities. This attraction to lakes, bays, bayous, marshlands, beaches, and the Gulf of Mexico is heightened by the biological wealth and productivity of the fragile estuarine complexes that sustain such principal recreational pursuits as fishing, hunting, crabbing, and shrimping. The scenic and available water and shorefront areas sustain many land- and water-based activities that serve local recreationists and attract multitudes of tourists to the area.

G.1.3. With these qualities, the Mississippi and Louisiana Estuarine Areas study area is a valuable recreation resource of national significance. It includes the New Orleans metropolitan area and the Gulfport-Biloxi metropolitan area that combine to form a large local population base that is augmented by a large tourist industry.

EXISTING RECREATION SETTING

G.1.4. The existing recreational lands and facilities in the study area can be categorized into private, public, or commercial use types. Figure G-2-1 depicts the market area that consists of 10 Louisiana parishes and three Mississippi counties. Within this market area, one National Wildlife Area, two National Parks, one National Trail, seven

MISSISSIPPI AND LOUISIANA ESTUARINE AREAS STUDY

Report on Freshwater Diversion

to

Lake Pontchartrain Basin and Mississippi Sound

Appendix G

R E C R E A T I O N

G.0.1. This appendix presents basic data, calculations, and detailed considerations in analyzing and assessing the existing and potential recreation resources and needs of the project area. It also presents a proposed recreational plan of development consistent with planning goals and objectives and compatible with other plan features.

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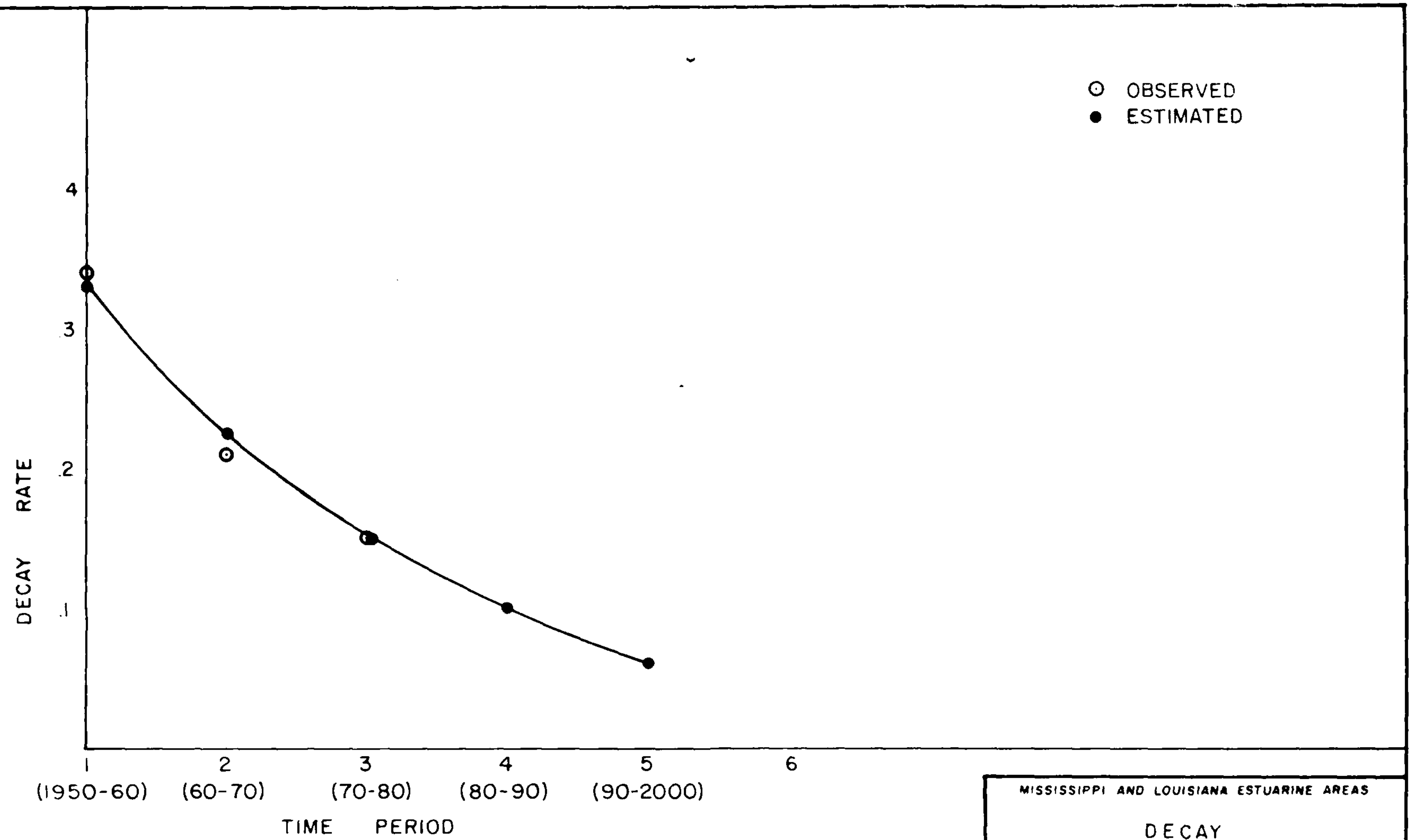
RECREATION RESOURCES



MISSISSIPPI AND LOUISIANA ESTUARINE AREAS

DECAY
RATE

US ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
APRIL 1984 FILE NO

FIGURE Ex - 2

FIGURE Ex - 2

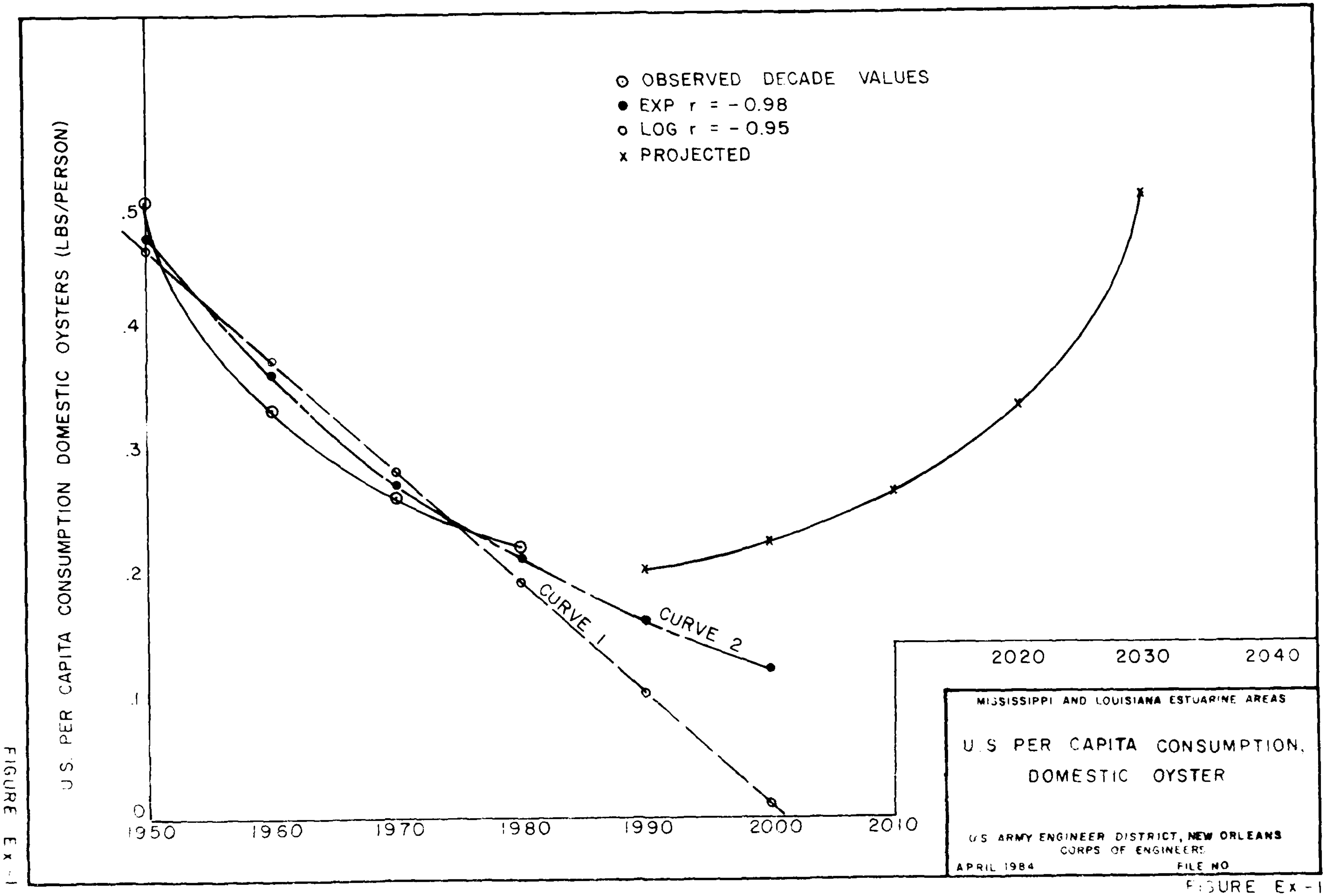


FIGURE Ex-1

FIGURE Ex-1

5. Decay rates in successive periods were calculated as shown below:

$Y_n = 1-5$	$Z_n = 1-5$	Decay Rate, $k_n = \frac{Y_n - Y_{n+1}}{Y_n}$
.50	1(1950-60)	$\frac{.50 - .33}{.50} = .34$
.33	2(1960-70)	$\frac{.33 - .26}{.33} = .21$
.26	3(1970-80)	$\frac{.26 - .22}{.26} = .15$
.22	4(1980-90)	estimated = .10
	5(1990-00)	estimated = .06

6. An exponential curve was fitted to these 3 points ($r = -.99$) and decay rates for time periods 4 (1980-1990) and 5 (1990-2000) were estimated (figure Ex-2).

7. Per capita consumption was calculated for 1990, $Y_5 = Y_4 - k_4 Y_4 = .20$.

8. Under Scenario I, this PCC value was held constant for the project life.

9. Under Scenarios II and III, PCC values for succeeding decades were assumed to return to the 1950 value at the same rate as the decline from 1950 to 1990 (figure Ex-1).

1990 = .20 lbs/person
2000 = .22 "
2010 = .26 "
2020 = .33 "
2030 = .50 "
2040 = .50 "

Exhibit 1

PROJECTION OF PER CAPITA CONSUMPTION, DOMESTIC LANDINGS (PCC)

1. PCC data for domestic landings were calculated using fisheries statistics and population figures from the "Statistical Abstract of the US" and "Fisheries of the US." Values were developed for each decade, 1950-80, and yearly for the period 1970-1981 (table F-2-1). These data are plotted on figure Ex-1.

2. Curves were fitted by least squares methods ($y = a + bx$) assuming both a linear relationship to time (trend line) and an exponential relationship ($y = ae^{bx}$, or, $\ln y = \ln a + bx$). Curves 1 and 2.

3. A close fit was obtained ($r = -.95$ and $-.98$), however, projections of PCC for 1990 and 2000 were unrealistic, approaching zero in one case. Fathermore, the plotted historical relationship appeared to be nonlinear and asymptotic, i.e., some oysters will always be demanded. This certainly has an intuitive appeal.

4. Based on the limited data at hand, it was assumed that the trend line was best described as nonlinear, decreasing by a decreasing decay rate, k, so that $Y_{n+1} = Y_n - k_n Y_n$, where k is an exponential function of successive time periods z, defined as $k = ce^{mz}$ or, $\ln k = \ln c + mz$.

TABLE G-1-1 (Continued)

EXISTING OUTDOOR RECREATIONAL FACILITIES INVENTORY
BY PARISH OR COUNTY

Livingston Parish

Proprietorship/ Facility Name	Boat Launching Lanes	Other Amenities
Commercial Areas		
Aime's Canal Bank Club	1	
Val's Marina	1	
Black Lake Club	1	
Warsaw Landing	1	Camping, Slips
Blood River Landing	1	Slips
Tickfaw Marina	1	
Carthage Bluff Landing	1	
Catfish Landing	1	

TABLE G-1-1 (Continued)

EXISTING OUTDOOR RECREATIONAL FACILITIES INVENTORY
BY PARISH OR COUNTY

Ascension Parish

Proprietorship/ Facility Name	Boat Launching Lanes	Other Amenities
State Areas		
LDWF Boat Ramp	1	
Parish Areas		
Riverview Park (Donaldsonville)	1	Picnic Area, Scenic Vista

TABLE G-1-1 (Continued)

EXISTING OUTDOOR RECREATIONAL FACILITIES INVENTORY
BY PARISH OR COUNTY

St. James Parish

Proprietorship/ Facility Name	Boat Launching Lanes	Other Amenities
Parish Areas		
Weber Steib Boat Ramp	1	
Local Areas		
Bayou Chevreuil Launch	1	
Commercial Areas		
Boat Ramp	1	

TABLE G-1-1 (Continued)

EXISTING OUTDOOR RECREATIONAL FACILITIES INVENTORY
BY PARISH OR COUNTY

St. John the Baptist Parish

Proprietorship/ Facility Name	Boat Launching Lanes	Other Amenities
State Areas		
Manchac Wildlife Management Area		5,261 Hunting Acres
Parish Areas		
LaPlace Boat Ramp	1	
Parish Boat Ramp	1	
LaPlace Oilfield Boat Ramp	1	
Ruddock Boat Ramp	1	

TABLE G-1-1 (Continued)

EXISTING OUTDOOR RECREATIONAL FACILITIES INVENTORY
BY PARISH OR COUNTY

St. Charles Parish

Proprietorship/ Facility Name	Boat Launching Lanes	Other Amenities
State Areas		
Salvador Wildlife Management Area		27,304 Hunting Acres
Parish Areas		
Bonnet Carre' Spillway Recreation Area	8	68 Acres, Camping, Picnicking, Boating, Waterskiing.
Boat Ramp #1 Hwy. 3127	1	
Boat Ramp #2 Hwy. 3127	1	
Commercial Areas		
Loupe's Boat Ramp	1	
Pier I	1	
Pier II	1	
Jeffrey Dufresne Boat Launch	1	
Sportsman Wharf	1	

TABLE G-1-1 (Continued)

EXISTING OUTDOOR RECREATIONAL FACILITIES INVENTORY
BY PARISH OR COUNTY

Jefferson Parish

Proprietorship/ Facility Name	Boat Launching Lanes	Other Amenities
Federal Areas		
Barataria Unit - Jean Lafitte National Historical Park		20,000 Acres
National Recreation Trail		10.5 Miles
State Areas		
Grand Isle State Park (East and West)		140 Acres, Seashore Recreation, Camping, Fishing.
Parish Areas		
Williams Boat Launch	8	Fishing Pier, Courtesy Docks, Gazebo and Overlook.
Bonnabel Boat Launch	8	Fishing Pier, Courtesy Docks, Gazebo and Overlook.
Bayou Segnette Boat Launch	10	Courtesy Docks
Commercial Areas		
Joe's Landing		Boat Hoist
Seaway Marina		Boat Hoist
Lafitte Marina		Boat Hoist
Bon Voyage Marina	1	Boat Hoist, Slips.
Bridge Side Marina	1	Boat Hoist
Cigar's Marina	1	Boat Hoist
Cheramie Marina	1	Boat Hoist, Slips.

TABLE C-1-1 (Continued)

EXISTING OUTDOOR RECREATIONAL FACILITIES INVENTORY
BY PARISH OR COUNTY

St. Bernard Parish

Proprietorship/ Facility Name	Boat Launching Lanes	Other Amenities
Federal Areas		
Delta-Breton National Wildlife Refuge		48,800 Acres
Chalmette Unit - Jean Lafitte National Historical Park		500 Acres
State Areas		
Biloxi Wildlife Management Area		39,728 Hunting Acres, Camping, Fishing.
St. Bernard State Park	1	358 Acres, Camping, Picnicking.
Parc Chenier	1	17.8 Acres, Camping, Picnicking, Fishing.
Commercial Areas		
Reggio Marina	1	Boat Hoist
Chalmette Marina	1	Boat Hoist
Pip's Place		Boat Hoist
Molero's Marina	1	2 Boat Hoists
Hopedale Marina		Boat Hoist
S&S Boat Marina	1	
Ritchard Campo's Launch		2 Boat Hoists
Alphonso's Marina		Boat Hoist
Al Campo's Marina		2 Boat Hoists
Rudy Melerine's	2	
Gulf Outlet Marina	2	Boat Hoist
Frank Campo's	1	
Gagnon's Marina	1	
Ernest Melerine's Launch	1	
Mack Melerine's Launch	1	
End of the World Marina	1	
Dudenhefer's Marina		Boat Hoist
Blackie Campo's		Boat Hoist

TABLE G-1-1 (Continued)

EXISTING OUTDOOR RECREATIONAL FACILITIES INVENTORY
BY PARISH OR COUNTY

Hancock County

Proprietorship/ Facility Name	Boat Launching Lanes	Other Amenities
<u>State Areas</u>		
Buccaneer State Park		394 Acres, Wave Pool.
<u>Local Areas</u>		
<u>Bay St. Louis</u>		
American Legion Pier and Landing	1	Fishing Pier
<u>Waveland</u>		
Garfield Ladner Memorial Pier	1	Fishing Pier
<u>Unincorporated Areas</u>		
Logtown Landing	1	
Pearlington Landing	1	
Bayou Cadet Landing	1	
Blue Meadow Landing	2	
McLeod Water Park		

TABLE G-1-1 (Continued)

EXISTING OUTDOOR RECREATIONAL FACILITIES INVENTORY
BY PARISH OR COUNTY

Harrison County

Proprietorship/ Facility Name	Boat Launching	Other Amenities
<u>Federal Areas</u>		
Gulf Islands National Seashore - Ship Island		87 Acres, Picnicking, Fishing.
Big Biloxi River Recreation Area		27 Acres, Camping, Picnicking.
Airey Lake Recreation Area		6 Acres, Camping, Picnicking.
Fort Massachusetts		Ship Island
<u>State Areas</u>		
Gulf Marine State Park		3.5 Acres
Gulf Marine Pier		
Little Biloxi Wildlife Management Area		
Mississippi Sand Beach		
<u>County Areas</u>		
Bayou Portage Landing	1	
Rowe's Bridge Landing	1	
Harrison County Fishing Pier		
<u>Local Areas</u>		
<u>Pass Christian</u>		
Pass Christian Small Craft Harbor	2	
Pass Christian Yacht Club and Marina		
<u>Long Beach</u>		
Long Beach Small Craft Harbor	2	

TABLE G-1-1 (Continued)

EXISTING OUTDOOR RECREATIONAL FACILITIES INVENTORY
BY PARISH OR COUNTY

Harrison County (Continued)

Proprietorship/ Facility Name	Boat Launching	Other Amenities
Gulfport		
Gulfport Small Craft Harbor	4	
Courthouse Road Pier	2	Fishing
Moses Pier		Fishing
Westside Public Pier		Fishing
Biloxi		
Biloxi Small Craft Harbor		
Biloxi Fishing Bridge - US Highway 90		
Oak Street Pier and Ramp	1	Fishing
Kuhn Street Pier and Ramp	1	Fishing
Old Ice Wharf	1	Fishing Pier, Ramp
Hopkins Street Fishing Pier		
Porter Avenue Fishing Pier		
Forest Avenue Pier and Ramp	1	Fishing
Harrison Avenue Pier		Fishing
Business Men's Pier and Ramp	1	Fishing

TABLE G-1-1 (Continued)

EXISTING OUTDOOR RECREATIONAL FACILITIES INVENTORY
BY PARISH OR COUNTY

Jackson County

Proprietorship/ Facility Name	Boat Launching Lanes	Other Amenities
Federal Areas		
Gulf Islands National Seashore - Davis Bayou Park		9,134 Acres
Gulf Islands National Seashore - Horn Island		
State Areas		
Shepard State Park		600 Acres
Red Creek Wildlife Management Area		
County Areas		
Ocean Springs Inner Harbor		Small Craft Harbor
Local Areas		
Ocean Springs		
Ocean Springs Small Craft Harbor	2	
Bristol Boulevard Boat Ramps	2	
Moss Point		
Belleview Street Boat Ramp	1	
Choctaw Boat Ramp	1	
Moss Point Boat Ramp	1	
Pascagoula		
Pascagoula Small Craft Harbor	2	Marina
Anderson Point Boat Ramp	1	
Old Spanish Fort Boat Ramp	1	
West Bank Boat Ramp	1	
Unincorporated Areas		
Ann Street Boat Ramp	1	
Bayou Casotte Boat Ramp	1	
Bayou Castelle Boat Ramp	1	

TABLE G-1-1 (Continued)

EXISTING OUTDOOR RECREATIONAL FACILITIES INVENTORY
BY PARISH OR COUNTY

Jackson County (Continued)

Proprietorship/ Facility Name	Boat Launching Lanes	Other Amenities
Biloxi Bay Boat Ramp	1	
Dees Landing Boat Ramp	1	
Fairway Drive Boat Ramp	1	
Four Mile Creek Boat Ramp	1	
Graveline Bayou Boat Ramp	1	
Jackson County Ski Area Boat Ramp	1	
Lyon's Lake Boat Ramp	1	
Old Font Bayou Boat Ramp	1	
Pascagoula River Boat Ramp	1	
Pollock Ferry Boat Ramp	1	
Rue Versailles Boat ramp	1	
St. Martin Road Boat Ramp	1	
Tower Bridge Street Boat Ramp	1	

LIMITING USE FACTORS

G.1.12. Although there is a great potential for public recreation along the Louisiana/Mississippi coast, there are limiting use factors that have prevented the potential from being realized. Many of the limiting factors are a function of access or lack of it.

G.1.13. A great demand is placed on existing recreation resources. During the summer season, in particular, the demand exceeds the supply for many resources in this region.

G.1.14. The number of currently available boat ramps is not adequate to meet the demands of potential users. Many existing facilities are not developed to their full potential and are often in areas of limited road access. The result is underutilized and nonuniform resource use.

G.1.15. The issues of private land ownership and private use compound the problem of public accessibility. Some lands in the study area are under private ownership and prohibited to public use. Many acres are leased for private uses including private camp development. Developing camps or vacation homes on private lands precludes public use and may directly block landward access to the shore. The camps are sometimes abandoned and left to deteriorate in the water or on the beaches or shores.

G.1.16. Other limiting factors that affect recreational use of the areas include the competition between commercial and recreational interests for the same resources. With land and road access limited by the physical environment, areas that could be used for recreation must vie with industrial and residential uses. The result is often congested strip development that aggravates the accessibility problem for recreationists.

G.1.17. Commercial fishing, oystering, and, to a lesser extent, trapping utilize the resources of the area. While not a major impediment to recreation, these activities do compete with recreation and further limit its potential. Intensive mineral exploration and extraction activities occur in the area and tend to reduce the physical and visual attractiveness when concentrated.

PRINCIPAL RECREATION ACTIVITIES

G.1.18. Of the many heavily pursued recreational activities within the study area, the most significant project-associated land- and water-based activities are hunting and fishing, respectively.

G.1.19. Recreational fishing is by far the most significant heavily pursued activity in the study area. In the recreation market area, (10 Louisiana parishes and 3 Mississippi counties) 119,992 resident sport fishing licenses were issued in the 1981-1982 season.[1/] Most of the fishing that occurs is accomplished by boat. The boat use is reflected in the number of motorboat registrations issued in 1982 for the market area, 98,476, and by the results of the 1980 Louisiana Statewide Comprehensive Outdoor Recreation Plan (SCORP) Demand Survey that indicated the high ranking participation rate for freshwater fishing from a boat. This activity ranked second in the first preferred activity category and sixth in the second preferred activity category of all respondents statewide. Saltwater boatfishing did not rank in the

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[1/] This licensing data does not reflect the fact that fishing licenses are not required for residents and nonresidents fishing in Mississippi in specified brackish water areas and along the entire state coastal area, and for residents fishing in Louisiana using a rod, pole, or hook and line without a reel or artificial bait.

demand. The 20 percent beyond-the-market-area factor is represented as 0.8 in Column 11, table G-2-4.

G.2.24. By employing all the aforementioned applied factors, gross demand is translated into a net figure that measures demand for fishing and picnicking facilities and hunting days by all individuals who live in or travel into the market area to recreate.

SUPPLY

G.2.25. Hunting supply data was projected in terms of existing and future land use. Land use projections were cooperatively prepared by the US Fish and Wildlife Service and the US Army Corps of Engineers. Huntable acreage by major habitat type for each parish or county in the market area was converted to man-day per capita per acre by applying the optimal sustained yield harvest (biological harvest rate) for each hunting type as shown on table G-2-2 and G-2-3. The conversion to man-days was to facilitate translating final need figures into acreage requirements for any of the habitat types available for use. Migratory bird hunting man-days of supply were calculated separately and then added to small game hunting supply for the needs determination.

G.2.26. Market area supply data in the form of boat launch lanes were available for fishing activities. These data were contained in the Louisiana SCORP "1980 Recreational Inventory" and the Mississippi Gulf Regional Planning Commission's "1980 Recreation Facilities Inventory." There are 202 launch lanes that currently serve the 13 parish/county market area. For measurement purposes, these lanes were prorated between salt and freshwater fishing on the basis of their relative participation rates. Thus, 156 lanes were allocated to freshwater

privately owned and are not generally open to the public. The amount of hunting use that could reasonably be expected at a public area is insignificant when compared with the privately held lands. By comparison, fishing waters are in public ownership and open to all potential users. Access to these waters is the factor that limits use, not the areal extent of the water itself. In quantifying relative demand, the factor measuring public versus private demand (and to a lesser degree, picnicking) requires publicly accessible facilities in order to be satisfied. This factor becomes important in the needs analysis because the supply inventory consists of only those facilities accessible to the general public on a free or commercial fee basis.

G.2.22. For several reasons, not all recreation demand can or should be satisfied in a particular market area. The public has diverse recreational interests and tends to satisfy recreational demands at various locations that may or may not be near the point of origin. In addition, certain recreational pursuits may be engaged in only where the source of supply exists, such as deep sea fishing in coastal water bodies or snow skiing in the mountains. As a result, a factor was designed to measure the amount of demand that should be provided to satisfy the potential user within a geographic context. By analyzing each activity, respective percentages were derived that would reduce overall demand levels to the amount that is desired and that should be satisfied in the market area and not elsewhere in the State of Louisiana or in the United States. These percentages are shown in Column 10 of table G-2-4.

G.2.23. Conversely, a factor to measure the demand from outside the market area that would be met in the market area was applied to the demand equation. The factor is based on the original postulate that the market area population contributes only 80 percent of the total

pursued in the project area could not be ascertained. The bulk of the project area is accessible only by boat. Therefore, all references in this report refer only to those fishing activities that use boats unless otherwise specified. Hunting does not have a single standard since its use varies by habitat type. The subsections "Supply" and "Need" identify how hunting use was determined.

G.2.19. Applying the preceeding adjustment factor, the fishing and picnicking demand expressed in activity occasions can now be expressed in average high-quarter day demand by resource or facility units. Hunting is still measured in total annual man-days demanded.

G.2.20. Demand is a general expression and specific associations to the market area can be vague unless properly defined. Two additional factors were developed to define associations. One factor relates to public versus private satisfaction of demand. Demand responses in the 1980 SCORP survey do not account for the level of an activity that will occur at exclusive sites not open to the public even for a fee, such as private boat docks or permanent boatslips that are only available to an owner or lessee. This type of facility does satisfy some demand. The degree of demand satisfaction should be apportioned to determine the demand for public facilities. In this study effort, each activity was analyzed to determine the percent or level of demand that should be satisfied by public facility developments. These percentages are shown in Column 9 of table G-2-4. Both the demand for and the supply of such facilities do not necessitate public ownership but can include commercial operations available to the public on a fee (commercial) basis.

G.2.21. The public-private factor was not measured for hunting activities in this study effort, but was used for picnicking and fishing. This is because most hunting lands in the project area are

the quarter) to measure the average daily demand that occurs in the peak season of use. Over the year, use of a facility will vary widely. However, by planning facilities to meet high-quarter daily demands satisfactorily, the assumption is that the facilities would be more than adequate to handle the visitation that would occur during the remainder of the year. A high-quarter day was not calculated for hunting activities because hunting carrying capacities are expressed over a hunting season (the high quarter) on a sustained yield harvest by varying land use and habitat types. Thus, although hunting demand is measured by hunting season, it is considered to be an annual demand figure.

G.2.17. The facility standard measures the amount of use a facility should receive daily under optimal conditions. These standards, as applied to the demand equation, are general guides that determine the number of facilities to be developed. After consultation and agreement between the Louisiana Department of Culture, Recreation and Tourism and the US Army Corps of Engineers, the facility standards in the 1977 Louisiana SCORP were modified for use in this study to more nearly reflect the type of facility developments that could be expected in the project area. Corps of Engineers guidelines and the "Heritage, Conservation and Recreation Service (HCRS) Outdoor Recreation Space Standards" provided additional sources of comparison in deriving the modified facility standards.

G.2.18. The picnicking standard is 7.7 users per day per picnic table. The fishing standard is 50 users per day per single boat lane. Although saltwater and freshwater fishing are measured in the demand survey in terms of "boat and other," no reasonable supply or conversion standard could be developed to measure the needs. While "other" reflects bankfishing, no measurement was made of the activity in this study. Admittedly, bankfishing does occur but the degree to which it is

Planning and Development District are transected. The adjusted market area participation rates were calculated by determining the proportion of the population of each planning region in the market area and weighing the market area participation rate by that percentage. This rate reflects the demand of the 45-mile market area with respect to its population, as adjusted, for both 1990 and 2040. These participation rates are presented in Column 3 of Table G-2-4 (at the end of this section). Migratory bird hunting does not have a participation rate as it was not separated from small game hunting in the demand survey conducted by the state. For purposes of the demand-need exercise, migratory bird hunting should be considered a part of small game hunting.

G.2.14. The market area population and participation rates for each activity are calculated and multipled together to yield the gross demand figure for the activity as measured in activity occasions. This calculation measures fishing and picnic usage for the high quarter of the year and hunting usage during the hunting season for all hunting activities. These are the periods in which demand is greatest.

G.2.15. Gross demand in activity occasions was determined according to the basic procedure. However, to more realistically define the degree and proportions of demand that can be satisfied within the market area, several factors were developed as integral parts of the equation. Applying these factors to the equation reduces gross demand stated in units of activity occasions to net demand stated in units of resource facilities. This transition is necessary to make the ultimate comparison between demand and supply and determine need in facility requirements.

G.2.16. One of the adjusting factors is the high-quarter day. The high-quarter demands were divided by 91.5 days (the number of days in

TABLE G-2-1

MISSISSIPPI AND LOUISIANA ESTUARINE STUDY AREA

Population Projections by Parish or County and by State Planning Region or District
For 1980, 1985, 1990, 2040

Region/District	Parish/County	1980	1985	1990	2040
1 New Orleans	SMSA*		1,212,200	1,275,500	1,730,500
	Jefferson Parish	454,592			
	Orleans Parish	557,515			
	St. Bernard Parish	64,097			
	St. Tammany Parish	110,869			
2 Baton Rouge	SMSA*		110,400	118,000	161,800
	Ascension Parish	50,068			
	Livingston Parish	58,806			
	Tangipahoa Parish	80,698	81,600	88,800	121,400
3	St. Charles Parish	37,259	39,000	41,900	62,100
	St. James Parish	21,495	22,000	22,500	26,500
	St. John the Baptist Parish	31,924	33,000	35,400	51,500
S. Miss. Planning & Dev. District	Biloxi-Gulfport SMSA*		190,700	199,800	277,400
	Hancock County	24,537			
	Harrison County	157,665			
S. Miss Planning & Dev. District	Pascagoula-Moss Pt. SMSA*		141,400	156,800	245,100
	Jackson County	118,015			
Study Area Totals		1,767,540	1,830,300	1,938,700	2,676,300

*SMSA - Standard Metropolitian Statistical Area. Projections were disaggregated from SMSA totals which included other parishes to reflect a realistic population for those counties and parishes making up the study area for 1985 and beyond.

population composition, and the individual participation rate of each activity measured.

G.2.10. "The Plan Formulation and Evaluation Studies - Recreation," Volume II, US Army Corps of Engineers Institute for Water Resources, postulates that an area contributing 80 percent of the day-use visitation is defined as the market area. Using this postulate, an analysis of the "Fish and Wildlife Study of the Louisiana Coastal Area and the Atchafalaya Basin Floodway, 1974," prepared by the US Army Corps of Engineers, New Orleans District, and the 1980 Louisiana SCORP Demand Survey revealed a primary market influence zone of 45 miles. Ten Louisiana parishes and 3 Mississippi counties whose population centers fall in this radius constitute the market area for the recreation demand-need analysis.

G.2.11. Parishes and counties that make up the market area and their population projections for 1990 and 2040 are shown in table G-2-1. Projected populations for the market area parishes were extracted from 1980 Bureau of Economic Analysis OBERS Regional Projections and are shown by parish or county and the state planning region or planning and development district in which the parish or county lies.

G.2.12. The 1980 Louisiana SCORP Demand Survey was used to identify participation rates for each of the picnicking, hunting, and fishing activity types. The State of Louisiana measured high-quarter recreational preferences (per capita participation rate) by regions and compared these expressions with the known supply of activities to determine need by the activity type.

G.2.13. These rates were modified to reflect the study market area. With the 45-mile radius of the market area as the outer boundary, Louisiana State Planning Regions 1, 2, and 3 and the South Mississippi

of the boat access development. In order to determine if the incremental addition of picnicking is warranted, the activity has been measured in terms of its demand, supply, and need.

G.2.8. The approach used in this study to determine needs is not identical in every detail to the approaches in the Mississippi or Louisiana SCORP. This study and both SCORPs are generally similar. However, it was necessary to present one method of analysis for a market zone that is not identical to the reporting zones or regions found in either SCORP. As a result some modifications and assumptions were introduced. In particular, the per capita demand rates extracted from the 1980 Louisiana Demand Survey were applied to a market area that included three Mississippi counties.[1/] In addition, several factors were applied to the demand equation to refine the measurement of expected or anticipated annual use. The facility standards for fishing and picnicking are not the same as those contained in either SCORP, but are similar to both. The results of the demand-need analysis for the Mississippi and Louisiana Estuarine Areas study are felt to be accurate measurements that are not skewed out of proportion with either SCORP but reflect the order of magnitude of needs represented in the market area for both states.

DEMAND

G.2.9. Demand is commonly viewed as an individual expression of desire to engage in an activity in a given area. To calculate demand, two essential components must be determined: the market area and its

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1/ Demand rates for the Mississippi counties were unavailable. Louisiana demand rates were deemed applicable because of the close proximity and similarity of use of the Mississippi and Louisiana coastal areas.

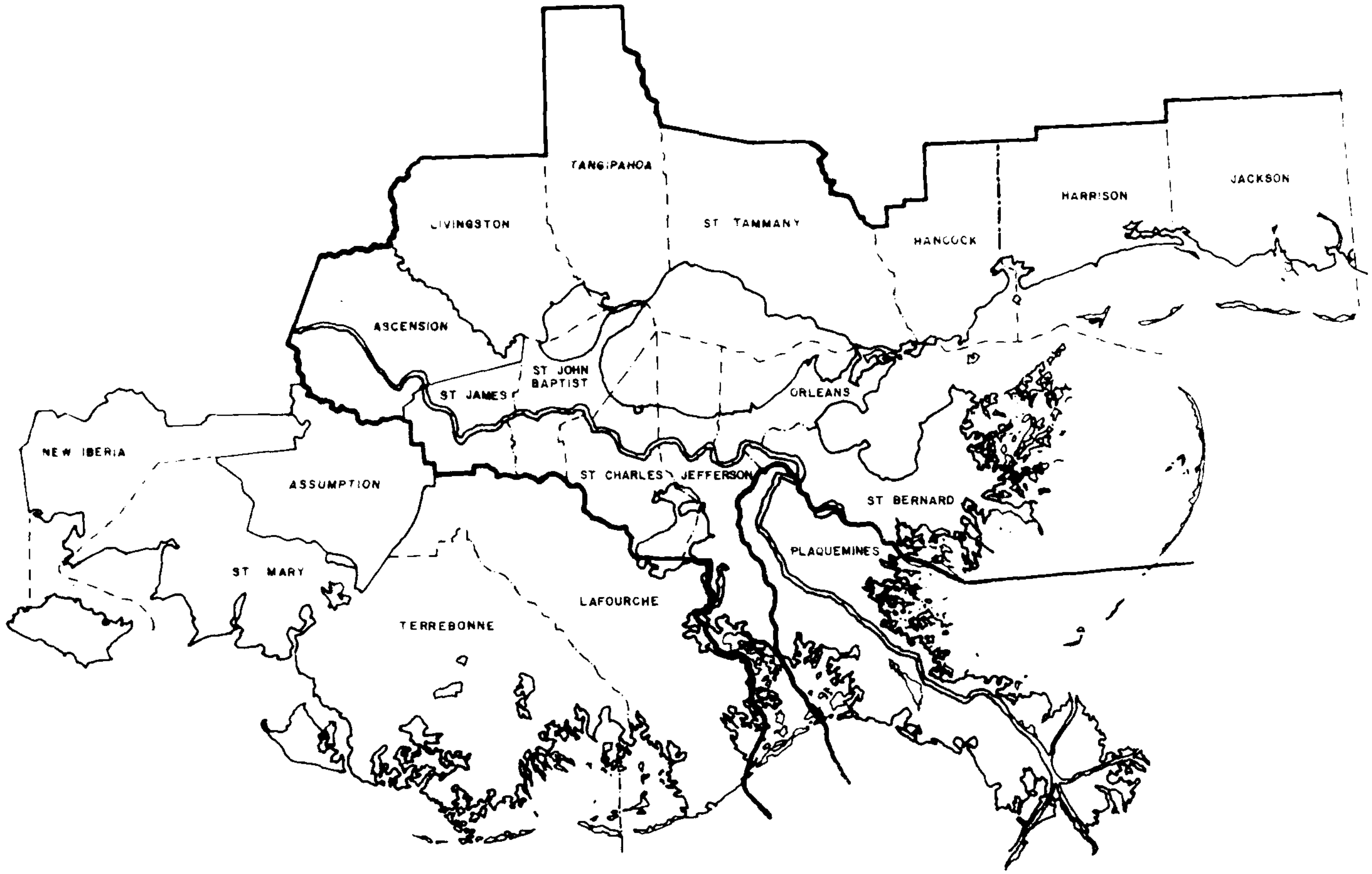
demand, supply, and need. Need is defined as that amount remaining when all demand is compared with the existing supply (demand - supply = need). These three components, in turn, require numerous interim calculations in their respective determinations.

G.2.6. Before the demand-need analysis was initiated, specific activities were identified that would be directly affected if the project were implemented. How the activity and the level of use would be affected by freshwater introduction was then determined. Identifying and characterizing the activities in this way focused on the actual impacts and the manner in which changing conditions could be quantified.

G.2.7. Although the public pursues many recreation activities in this region, freshwater diversion is expected to directly affect two primary activities, hunting and fishing. Nonconsumptive water-based activities do not depend on salinity levels or marsh preservation. Private hunting leases are extensive but generally exclude use by nonmembers. Private camps are numerous and are support facilities for the hunting and fishing that are the major attractions to the area. The basic recreation activities measured in the demand-need analysis were:

- Freshwater fishing
- Saltwater fishing
- Big game hunting
- Small game hunting
- Migratory bird hunting
- Waterfowl hunting

In addition to these consumptive uses, one nonconsumptive use, picnicking, was measured. The reasoning for its inclusion is that any provision of boat launch areas as a result of a need indicator would include a small number of picnic tables adjacent to the launch as a part



MISSISSIPPI AND LOUISIANA ESTUARINE AREAS

RECREATION MARKET AREA

U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

APRIL 1984 FILE NO.

FIGURE G-2-1

FIGURE G-2-1

Section 2. RECREATION DEMAND AND NEED ANALYSIS

OVERVIEW OF METHODS AND OBJECTIVES

G.2.1. For this study, a regional analysis was used to determine recreational needs. The analysis is a generalized way of presenting recreational supply/demand relationships for land and water use within the project recreation market area and is similar to that used by many states in preparing their Statewide Comprehensive Outdoor Recreation Plan (SCORP).

G.2.2. The analysis had three objectives: to determine the demand for the primary water-based and land-based recreational activities within the project market area, to translate demands for these activities into facility needs, and to use this information in identifying impacts and potentials for recreational and fish and wildlife development in the project areas.

G.2.3. The scope of the analysis covered the 10 southeastern Louisiana parishes and 3 Mississippi counties that form the project market area (figure G-2-1). Demand and need are projected for target years 1990 and 2040, spanning the portion of the project life for which projections can realistically be made.

G.2.4. A current, extensive data base suitable for the complex demand-need analysis is not available. Therefore, usable information necessary to complete the analysis had to be extrapolated from several sources. Sources and methods of extrapolation will be discussed as the analytical demand equation is detailed.

G.2.5. The complete demand-need determination equation is complex. Viewed in its simplest form, however, it is composed of three elements:

area. At the same time, additional nature- and human-induced destruction of the resource base will heighten the competition for and the use of the remaining resources. Traditional recreation activities are expected to decline as conflicts with other uses arise.

G.1.26. Hunting activities will be affected as subsidence, erosion, and land use conversions destroy the more productive habitats. Although fishing is not subjected to a shrinking resource base, in terms of available water surface acreage the activity will also suffer qualitatively as the marsh types on which its productivity levels depend are destroyed.

PRESENT RECREATION USE TRENDS

G.1.24. Recreation resources of the primary market area are somewhat diversified as shown by the types of recreational developments in the facilities inventory. Within a more narrowly defined project-affected area, however, recreational activities are more intensely directed towards several specific activity types. The waterways, coastal marshes, and wetlands of coastal Louisiana and Mississippi have historically generated and supported a way of life for local residents. This way of life continues to be sustained through the pursuit of such activities as fishing and hunting. The overall attraction is based on the availability of land and water resources and the abundance of fish and wildlife resources. In the project-affected area, the marsh-estuarine complex grades from freshwater tupelogum-cypress swamps across marshland environments into saline nearshore and shelf environments. These various environments are connected by north-south flowing bayous and tidal estuarine systems, and by a maze of artificial canals and waterways that have been constructed by trappers and oil and gas interests. Except where parks or other public facilities have been developed, use of the freshwater swamps is generally restricted to crawfishing, deer hunting, waterfowl hunting, small game hunting, sport fishing, and recreational boating. Waterfowl hunting during the fall season is extremely popular in the lakes and bayous of fresh and brackish water environments. Where waters become more saline in nature, the more popular recreational activities are crabbing, shrimping, and saltwater fishing.

FUTURE RECREATION USE TRENDS

G.1.25. Increased industrial development and associated population growth will place heavier pressures on recreation uses of the study

top ten activities measured in the 1980 Demand Survey. A degree of overlap in respondent preferences could have occurred because of the difficulty in differentiating between salt and freshwater fishing in the coastal areas of Louisiana.

G.1.20. The complex stratification of fresh and saline marsh types supports both fresh and saltwater fishing. Neither type dominates the total fishing use and common launch areas are often used for both types.

G.1.21. Crabbing, shrimping, and deep sea fishing for recreation are quite popular throughout the area but exact user figures are not available.

G.1.22. Hunting activities are as varied as fishing activities. Hunting for small game is the most prevalent activity and a wide range of species and associated habitat types are available. Big game hunting for whitetail deer is relegated to the freshwater habitats and is not as intensive as in more productive habitats such as bottomland hardwoods. Waterfowl hunting is the most well-known hunting activity in the study area although its demand is lower than other hunting activities. For the 1981-82 hunting season, 106,625 resident hunting licenses were issued in the 10-parish/3-county market area.

G.1.23. The primary users of the recreation resources of the area are residents of southeast Louisiana and southern Mississippi. The 1980 survey conducted by the Louisiana Department of Culture, Recreation and Tourism, Division of Outdoor Recreation, Office of Program Development, indicates that 81.7 percent of boat fishing activity occasions and 86.6 percent of the small game hunting activity occasions occur within 45 miles of the participant's residence.

TABLE [illegible]

POTENTIAL MAN-DAYS OF HUNTING SUPPLY BY HABITAT USE CAPACITY

Habitat Type	Man-day Capacity Per Acre	1978 Acreage	Man-day Supply	1990 Acreage	Man-day Supply	2040 Acreage	Man-day Supply
BOTTOMLANDS HARDWOODS		90,732		87,153		74,[illegible]2	
Big Game Hunting	.130		11,795		11,330		9,627
Small Game Hunting	.832		77,304		74,254		63,092
Migratory Bird Hunting	.000		0		0		0
Waterfowl Hunting	.016		1,452		1,394		1,185
WOODED SWAMP		188,669		166,233		102,6[illegible]7	
Big Game Hunting	.130		24,527		21,610		13,349
Small Game Hunting	.848		159,991		140,966		87,079
Migratory Bird Hunting	.000		0		0		0
Waterfowl Hunting	.053		9,999		8,81[illegible]		5,442
FRESH AND INTERMEDIATE MARSH		78,231		68,744		[illegible],972	
Big Game Hunting	.029		2,269		1,994		1,594
Small Game Hunting	.164		12,830		11,274		9,015
Migratory Bird Hunting	.188		14,707		12,924		10,335
Waterfowl Hunting	.488		38,177		33,547		26,826
BRACKISH MARSH		157,604		149,141		119,723	
Big Game Hunting	.000		0		0		0
Small Game Hunting	.131		20,646		19,537		15,684
Migratory Bird Hunting	.188		29,630		28,039		22,508
Waterfowl Hunting	.383		60,362		57,121		45,854
SALINE MARSH		83,711		76,803		54,695	
Big Game Hunting	.000		0		0		0
Small Game Hunting	.033		2,762		2,534		1,805
Migratory Bird Hunting	.253		21,179		19,431		13,838
Waterfowl Hunting	.018		1,507		1,382		985

TABLE C-2-3

TOTAL MAN-DAYS OF HUNTING SUPPLY BY HABITAT TYPE

	Man-Days					
	Fresh Marsh	Brackish Marsh	Saline Marsh	Bottomland Hardwoods	Wooded Swamp	Total
1978						
Big Game Hunting	2,269	0	0	11,795	24,527	38,591
Small Game Hunting	12,830	20,646	2,762	77,304	159,991	273,533
Migratory Bird Hunting	14,707	29,630	21,179	0	0	65,516
Waterfowl Hunting	38,177	60,362	1,507	1,452	9,999	111,767
[illegible]						
Big Game Hunting	1,994	0	0	11,330	21,610	34,934
Small Game Hunting	11,274	19,357	2,534	74,254	140,966	248,565
Migratory Bird Hunting	12,924	28,039	19,431	0	0	60,394
Waterfowl Hunting	33,547	57,121	1,382	1,394	8,810	102,254
[illegible]						
Big Game Hunting	1,594	0	0	9,627	13,349	24,570
Small Game Hunting	9,015	15,684	1,805	63,092	87,079	176,675
Migratory Bird Hunting	10,335	22,508	13,838	0	0	46,681
Waterfowl Hunting	26,826	45,854	985	1,185	5,442	80,292

fishing and 46 lanes to saltwater fishing. Existing supply figures were used to calculate future needs.

G.2.27. Picnicking data were available from the Louisiana SCORP "1980 Recreational Inventory" and the 1976 Mississippi SCORP. Both sources contained inventories of the number of picnic sites by parish/county. There are 2,931 picnic tables in the Louisiana portion and 746 picnic tables in the Mississippi portion of the market area. As in the case of fishing, existing supply figures were used to calculate future needs.

NEEDS

G.2.28. Market area needs for each recreational activity type were obtained by subtracting the market area supply from the net market area demand. A positive net need indicates that recreational development to accommodate existing and future use is justifiable on the basis of demand and warrants consideration.

G.2.29. Needs for activities have been stated in terms of recreational resource facility needs. Hunting needs have been stated in terms of man-days. A conversion to acres of need for hunting for any habitat type can be easily accomplished by dividing man-days of need by the respective habitat carrying capacity. The entire equation of demand, supply, and need for all activities is shown on table G-2-4. The analysis is given for 1990 and 2040 and displays an increase in need indicators for the future.

G.2.30. The needs analysis is intended to ascertain general supply-demand relationships for the project market area. The analysis is regional in nature and is intended to identify the potential demand that could be associated with the project. It should not be inferred that

all needs for parishes/counties in the market area could or would be met by recreational considerations associated with the project.

G.2.31. The needs analysis of the market area shows an overall recreational need for the hunting, fishing, and picnicking activities considered. Crabbing and shrimping were not measured in this study. No distinction between finfishing and shellfishing was made in the demand survey, thus eliminating the possibility of separating the activities. Crabbing and shrimping, however, use launch lanes in the same manner as fishing. Since fishing shows an enormous need in terms of additional lanes to accommodate demand, it is assumed that crabbing and shrimping also have a need for additional facility developments in the market area.

TABLE G-2-4

Recreation Demand - Need Equation

Year	Activity Type (1)	Market Area Population (2) (x)	Market Area Participation Rate (3) (=)	High Quarter Activity Occasions in User Days (UD) (4) (÷)	Days in High Quarter (5) (=)	Average High Quarter Day Demand (6) (÷)	Facility Standard (7) (=)	Gross Demand (8) (x)	Percent to be Met at Public Facility (9) (x)	Percent to be Met in Market Area (10) (÷)	Beyond Market Area Factor (11) (=)	Net[2] Market Area Demand (12) (-)	Net[3] Market Area Supply (13) (=)	Total Projected[4] Market Area Need (14)
1978	Freshwater Boatfishing	1,76[illegible]	4.68	9,272,087	91.5	90,405	50 UD/Lane	1,808 Lanes	.80	.60	.80	1,805 Lanes	156 Lanes	929 Lanes
	Saltwater Boatfishing		1.37	2,421,523	91.5	26,465	50 UD/Lane	529 Lanes	.70	.60	.80	277 Lanes	46 Lanes	231 Lanes
	Picnicking		3.43	6,062,662	91.5	66,259	7.7 UD/Table	8,605 Tables	.85	.85	.80	7,771 Tables	3,677 Tables	4,094 Tables
	Big Game Hunting		0.38	671,665	Season	N/A	N/A	N/A	N/A	.81	.80	680,061 User Days	43,952 User Days	636,109 User Days
	Small Game Hunting[1]		1.69	2,987,142	Season	N/A	N/A	N/A	N/A	.85	.80	3,173,838 User Days	339,049 User Days	2,834,789 User Days
	Waterfowl Hunting		0.43	760,042	Season	N/A	N/A	N/A	N/A	.85	.80	807,545 User Days	149,674 User Days	657,871 User Days
1985	Freshwater Boatfishing	1,830,300	4.68	8,565,804	91.5	93,615	50 UD/Lane	1,872 Lane	.80	.60	.80	1,123 Lanes	156 Lanes	967 Lanes
	Saltwater Boatfishing		1.37	2,507,511	91.5	27,404	50 UD/Lane	548 Lane	.70	.60	.80	288 Lanes	46 Lanes	242 Lanes
	Picnicking		3.43	6,277,929	91.5	68,611	7.7 UD/Table	8,911 Tables	.85	.85	.80	8,048 Tables	3,677 Tables	4,371 Tables
	Big Game Hunting		0.38	695,514	Season	N/A	N/A	N/A	N/A	.81	.80	704,208 User Days	38,691 User Days[5]	66,517 User Days
	Small Game Hunting[1]		1.69	3,093,207	Season	N/A	N/A	N/A	N/A	.85	.80	3,286,532 User Days	321,496 User Days[5]	2,965,036 User Days
	Waterfowl Hunting		0.43	789,029	Season	N/A	N/A	N/A	N/A	.85	.80	836,218 User Days	122,012 User Days[5]	714,206 User Days
1990	Freshwater Boatfishing	1,938,700	4.68	9,073,116	91.5	99,160	50 UD/Lane	1,983 Lane	.80	.60	.80	1,058 Lanes	156 Lanes	902 Lanes
	Saltwater Boatfishing		1.37	2,656,019	91.5	29,028	50 UD/Lane	580 Lane	.70	.60	.80	305 Lanes	46 Lanes	259 Lanes
	Picnicking		3.43	6,649,741	91.5	72,675	7.7 UD/Table	9,438 Tables	.85	.85	.80	8,524 Tables	3,677 Tables	4,847 Tables
	Big Game Hunting		0.38	736,706	Season	N/A	N/A	N/A	N/A	.81	.80	745,915 User Days	34,934 User Days	710,981 User Days
	Small Game Hunting[1]		1.69	3,276,403	Season	N/A	N/A	N/A	N/A	.85	.80	3,481,178 User Days	308,959 User Days	3,172,219 User Days
	Waterfowl Hunting		0.43	833,641	Season	N/A	N/A	N/A	N/A	.85	.80	885,743 User Days	102,254 User Days	783,489 User Days
2040	Freshwater Boatfishing	2,676,300	4.68	12,525,084	91.5	136,886	50 UD/Lane	2,738 Lane	.80	.60	.80	1,643 Lanes	156 Lanes	1,487 Lanes
	Saltwater Boatfishing		1.37	3,666,531	91.5	40,071	50 UD/Lane	801 Lane	.70	.60	.80	421 Lanes	46 Lanes	375 Lanes
	Picnicking		3.43	9,179,709	91.5	100,325	7.7 UD/Table	13,029 Tables	.85	.85	.80	11,767 Tables	3,677 Tables	8,090 Tables
	Big Game Hunting		0.38	1,016,994	Season	N/A	N/A	N/A	N/A	.85	.80	1,029,706 User Days	24,570 User Days	1,005,136 User Days
	Small Game Hunting[1]		1.69	4,522,947	Season	N/A	N/A	N/A	N/A	.85	.80	4,805,631 User Days	223,356 User Days	4,582,275 User Days
	Waterfowl Hunting		0.43	1,150,809	Season	N/A	N/A	N/A	N/A	.85	.80	1,222,735 User Days	80,292 User Days	1,142,443 User Days

1/ Includes Migratory Bird Hunting   2,3,4/ Hunting, Demand, Supply, and Need are Based on 1978 Data   5/ Based on Interpolated Data from 1978 and 1990 Projections

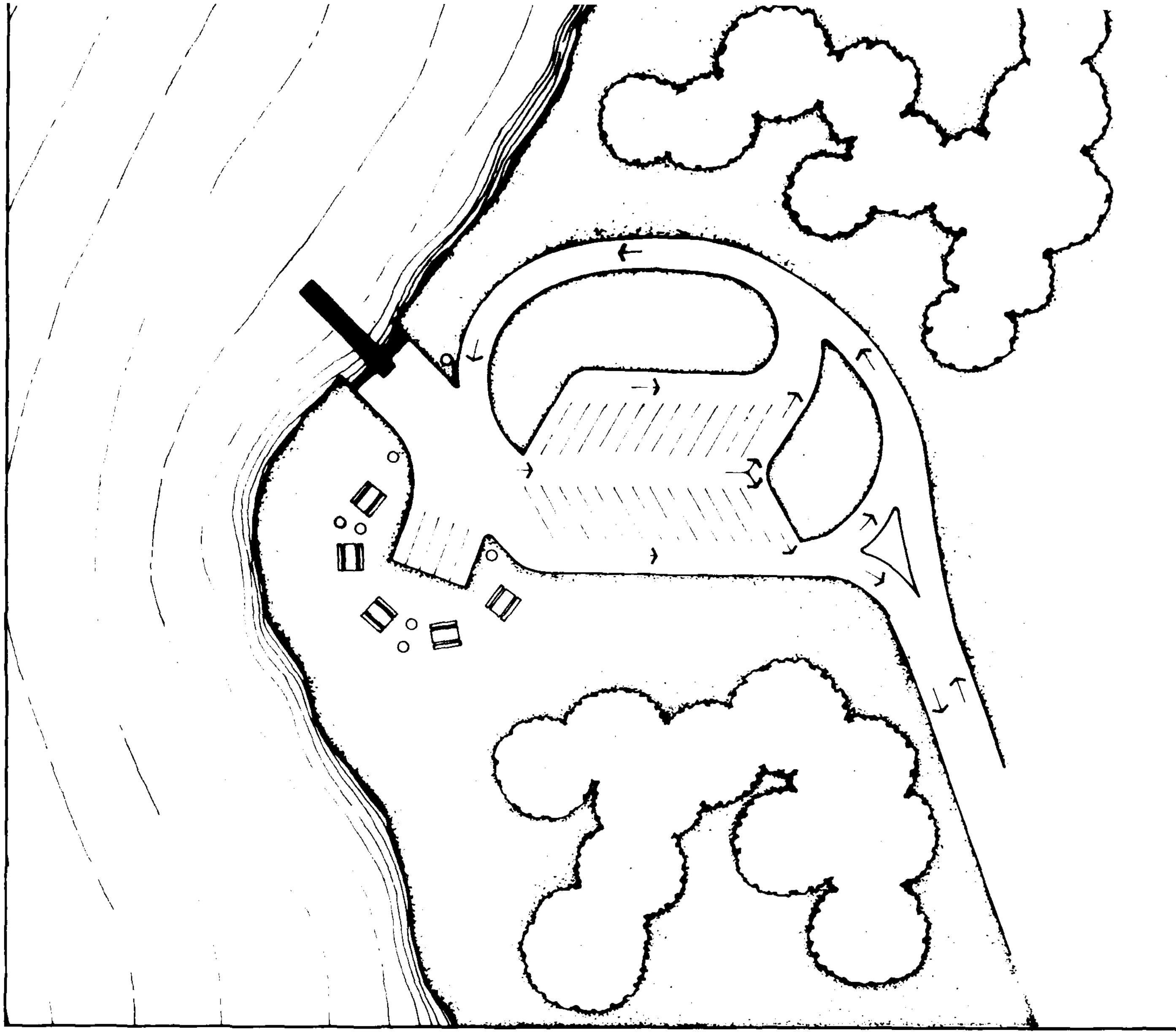
Section 3. RECREATION DEVELOPMENT PLAN

DEVELOPMENT PARAMETERS

G.3.1. The effects of freshwater diversion with the inherent purpose of improving the biological resources of the Mississippi and Louisiana Estuarine Areas are far reaching. Therefore, a plan was developed to increase public access to the enhanced waters of the project-affected area while satisfying a portion of the public need for outdoor recreation in the project market area.

G.3.2. The most significant constraints in proposing project-associated recreational developments were locating suitable development sites while minimizing real estate costs, and finding a local sponsor willing to cost-share the development and operate and maintain such development throughout the project life.

G.3.3. Considering these main objectives and constraints, the Corps of Engineers initiated a coordinated effort with the Louisiana Office of State Parks, the Mississippi Bureau of Marine Resources, and the Gulf Regional Planning Commission to identify several strategically located and potentially developable water access areas on small acreages adjacent to the project-affected waterbodies in the Mississippi and Louisiana estuarine system. Areas were selected that would encompass approximately 2 acres of land acquired in fee. Each area would accomodate development of a 2-lane concrete boat launching ramp with courtesy pier, a paved parking area suitable for parking 30 cars and trailers, and a small picnicking area with 5 picnic tables.
Figure G-3-1 represents a typical recreation site plan showing these amenities.



AMENITIES

TWO-LANE LAUNCHING RAMP
COURTESY PIER
PICNIC AREA
PULL-THRU PARKING

MISSISSIPPI AND LOUISIANA ESTUARINE AREAS

CONCEPTUAL SITE
DEVELOPMENT PLAN

US ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

APRIL 1984 FILE NO.

FIGURE G-3-1

FACILITY DESIGN CRITERIA

G.3.4. General. The number and types of facilities recommended for the various recreational areas are based principally on the projected recreational needs and the appropriateness of the facilities for the specific sites. Projected recreational use served as a guide to the number of facilities rather than absolute dictates. The intent was to optimize anticipated recreational benefits while minimizing operation and maintenance costs. The design criteria are a composite of pertinent criteria in Engineering Regulation 1110-2-400, Engineering Manual 1110-2-400[1/], Louisiana State Parks Planning Guidelines, and the Red River Waterway Master Plan for Resources Development.

G.3.5. Siting. For each of the recreational facilities, the most advantageous locations were sought in view of site conditions and recreational needs were sought. The intent has been to avoid construction limitations and environmental impacts while simultaneously maximizing recreational opportunities.

G.3.6. Occasional low-level flooding is a major siting limitation at nearly all recreation sites. Consequently, potentially affected facilities would be located above the 10-year flood level where possible. Structures located within the 100-year flood plain would be flood-proofed or designed of materials that can be easily cleaned and restored to operation after flooding. Sedimentation patterns are major constraints in the delineation of sites as well as the specific location of boat-launching ramps. Other limitations are considered minor and would be addressed during detailed siting construction.

1/ This Engineering Manual is currently under revision; however, at the time of this report the revised edition was not available.

G.3.7. Boat Launching Lanes/Ramps. Launching lane widths would be 12 feet and total ramp width would be 24 feet. Upper limit of the ramp would be 3 feet above the water stage that is equalled or exceeded 2-percent of the time (2-percent flowline). Lower limit of ramp would be located 4 feet below the annual average low water elevation. A minimum of 75 feet in diameter for a vehicular turnaround would be required. Ramps would be surfaced in scored or patterned concrete that is reinforced or prestressed. Ramp gradients would be between 13 and 15 percent. Ramp shoulders would be stabilized to prevent erosion. Six-inch curbs would be provided on both sides of the ramp. A total of 30 car/trailer parking spaces would be provided.

G.3.8. Day-Use Picnic Area. Picnic facilities would be provided near the boat launch area. A minimum of five picnic tables per acre and a minimum area of 225 square feet per picnic site would be required. Basic facilities would include:

- Concrete tables affixed to concrete impact areas.
- One cooking grill per table.
- One trash receptacle per table.

The parking lot planning and design would preserve existing vegetation for shade and screening. Car parking spaces 10 by 20 feet and car/trailer parking spaces 10 by 35 feet at a 45-degree angle should be provided. All road and parking surfaces would be paved asphalt. All site work would be conducted to minimize impacts on existing conditions.

RECOMMENDED SITE DEVELOPMENT

G.3.9. The recommended plan proposes that six 2-acre sites be developed: four within the Lake Ponchartrain Basin and two within the Mississippi Sound. These sites are identified on plate G-1. The Louisiana sites would be newly developed. The Mississippi sites are existing but inadequately developed water access areas that require substantial upgrading to reduce the intense use pressure currently placed on them. Of the four proposed recreational sites in Louisiana, the Frenier Beach and the Bonnet Carre' Spillway recreational areas are located on the southwest side of Lake Ponchartrain; the Point Aux Herbes and the Rigolets recreational areas are located on the east side of Lake Pontchartrain. The proposed recreational areas in Mississippi, Cedar Point and Wolf River, are located on the west and east sides of Bay St. Louis, respectively.

G.3.10. In selecting the proposed recreational development sites, several factors were considered. Among the most important were proximity of location to the project-affected areas, reasonableness of land acquisition costs, lack of or overuse of available existing access areas, and expressed public desire for additional boating as reflected in opinion surveys and in the recreational demand-need analysis.

G.3.11. Generally, the proposed recreation development sites would provide access in a linear fashion at fairly equidistant intervals along the entire length of the project-affected area. The Frenier Beach site would provide access into extreme southwest Lake Ponchartrain for freshwater fishing at an undeveloped point once heavily used by local fisherman that eroding wave wash and wind action has degraded.

G.3.12. The Point Aux Herbes and the Rigolets sites would provide access into extreme eastern Lake Pontchartrain, Chef Menteur Pass, the

Rigolets, Lake St. Catherine, and Lake Borgne. The development of these sites would relieve the current pressure on existing access sites including the Louisiana Department of Wildlife and Fisheries ramp at Fort Pike where exasperated boaters, fishermen, and shrimpers wait as long as three hours to launch and retrieve their boats during the heavy use season.

G.3.13. Cedar Point and Wolf River sites would provide access into Bay St. Louis and its backwaters and into the Wolf River and Mississippi Sound, affording the using public opportunity to pursue various water-based activities including both fresh and saltwater fishing, among the most popular and heavily demanded activities along the Mississippi Gulf Coast.

G.3.14. The Bonnet Carre' Spillway site, aside from being a prime site for potential recreational development, was selected for the purpose of providing access to the freshwater diversion channel, freshwater diversion structure, and appurtenances during construction and subsequent operation for inspection, maintenance, and monitoring purposes. Access to the diversion project is imperative for project operation purposes during diversion phases. However, the infrequency of such use would allow public use for the majority of the time, permitting boating access directly to both the diversion channel and to western Lake Ponchartrain. This site is expected to reduce heavy use of the two other existing boat launching facilities located within the spillway proper.

FACILITY DEVELOPMENT SUMMARY

G.3.15. Comments received from Federal, State, and local agencies review of the proposed recreation development plan were very favorable. St. Tammany parish has requested that similar recreation

facilities be located in the vicinity of Madisonville. St. Bernard Parish Police Jury and Coastal Advisory Committee adopted a resolution requesting that recreation facilities be considered at Fort Proctor in St. Bernard Parish adjacent to Lake Borgne. The resolution is exhibit 1. St. Charles parish recommended that recreation facilities be developed north of Airline highway inside Bonnet Carre' spillway. The facilities should include provisions for crawfish production and management. Considerations to modifying the proposed recreation development plan or the addition of more recreation sites would be given during the advanced engineering and design phase of the study.
The facility development as described in this section is summarized by type and number for each recreational development site in table G-3-1.

MISSISSIPPI AND LOUISIANA ESTUARINE AREA

Proposed Recreation Development Plan
Facility Development Summary

Site Name	Acreage	2 Lane Boat Launching Ramp	Picnic Tables	Trash Receptacles	1/2 acre Parking Area (30 Cars & Trailers)
Bonnet Carre' Spillway	2	1	5	5	1
Frenier Beach	2	1	5	5	1
The Rigolets	2	1	5	5	1
Pointe Aux Herbes	2	1	5	5	1
Cedar Point	2	1	5	5	1
Wolf River	2	1	5	5	1
TOTALS	10	6	30	30	6 (180 Cars & Trailers)

DEVELOPMENT COSTS

G.3.16. Cost estimates in 1983 dollars for the initial development of each recreational site as based upon facilities proposed for each site is shown in table G-3-2.

G.3.17. A contingency factor of 25 percent has been included, as well as 10 percent for engineering and design costs, and 9 percent for supervision and administration related to the construction of recreational facilities. Land costs are also included. Two percent of the total first costs, exclusive of land costs, was used for estimating annual operation, maintenance and replacement costs. The operation, maintenance, and replacement (O&M) costs would be borne by local sponsors. Because of the difficulty in estimating actual O&M costs that the local sponsor would incur for manpower capabilities, existing equipment inventories, salary requirements, etc., a 2-percent assessment of the total separable first costs of recreational facilities development, exclusive of land acquisition costs, was used to calculate the estimated annual O&M costs. This 2-percent figure is consistent with approved estimated O&M costs used for other US Army Corps of Engineers water resource development projects with similar recreational development administered by non-Federal entities.

DEVELOPMENT BENEFITS

G.3.18. Benefits for the recommended recreational development features are calculated by applying selected unit day values to projected annual use figures for the recreation activity types afforded by respective facility developments to arrive at an annual total dollar figure. More detailed information concerning unit day values and use projections is contained in Section 4 of this appendix. Additionally, table G-3-3

use determining variables were inadequate and were not time effective or cost effective to obtain. The application of a similar project method to derive a UEM for this study was rejected since no similar project exists with adequate surveys and observations from which to extrapolate applicable per capita use rates. As sufficent excess demand was exhibited in the market area, the next preferred method, the capacity use method of determining recreation use, was employed.

UNIT DAY PRICE DETERMINATION

G.4.19. Due to the lack of data necessary for use of the travel cost or contingent values method to evaluate recreational benefits, the values used in this study were derived from the range of unit day values provided by the Water Resources Council (WRC) and updated annually. The value ranges for recreation unit days contained in the WRC Principles and Guidelines as updated for 1984 are:

General Recreation - $1.65-$4.90
General Hunting & Fishing - $2.35-$4.90
Specialized Hunting & Fishing - $11.50-$19.50

G.4.20. Value selection from these ranges was determined by using the five criteria and standards that measure relative characteristics and attributes of the project area recreation features.

G.4.21. WRC definitions were used to differentiate between general and specialized recreation activities. Basically, general activities are thought of as those common to an area and of normal quality. Specialized activities are more extensive in use and relatively unique. For this study, big game hunting and waterfowl hunting are considered specialized while small game hunting, migratory bird hunting, freshwater and saltwater fishing, and picnicking are considered general.

TABLE [illegible]

PROJECT IMPACTS ON HUNTING ACTIVITIES BY HABITAT TYPES

Louisiana Estuarine Area

Year	Activity	Hunting Carrying Capacity: Wooded Swamp WS	Fresh Intermediate Marsh F/IM	Brackish Marsh BM	Acreage without Project: WS	F/IM	BM	Acreage with Project: WS	F/IM	BM
[illegible]	Big Game Hunting	[illegible]	.029	[illegible]	155,[illegible]	58,340	137,662	155,[illegible]	58,340	137,662
	Small Game Hunting	[illegible]	.064	.131	155,[illegible]	58,340	137,662	155,[illegible]	58,340	137,662
	Migratory Bird Hunting	[illegible]	.088	.188	155,[illegible]	58,340	137,662	155,[illegible]	58,340	137,662
	Waterfowl Hunting	[illegible]	[illegible]	.383	155,[illegible]	58,340	137,662	155,[illegible]	58,340	137,662
[illegible]	Big Game Hunting	[illegible]	.029	[illegible]	133,[illegible]	54,282	129,626	133,[illegible]	54,282	123,626
	Small Game Hunting	[illegible]	[illegible]	.131	133,[illegible]	54,282	129,626	133,[illegible]	54,282	129,626
	Migratory Bird Hunting	[illegible]	.088	.188	133,[illegible]	54,282	129,626	133,[illegible]	54,282	129,626
	Waterfowl Hunting	[illegible]	[illegible]	.383	133,[illegible]	54,282	129,626	133,[illegible]	54,282	129,626
[illegible]	Big Game Hunting	[illegible]	.029	[illegible]	116,868	51,111	123,288	118,488	55,513	119,740
	Small Game Hunting	[illegible]	[illegible]	.131	116,868	51,111	123,288	118,488	55,513	119,740
	Migratory Bird Hunting	[illegible]	[illegible]	.188	116,868	51,111	123,288	118,488	55,513	119,740
	Waterfowl Hunting	[illegible]	[illegible]	.383	116,868	51,111	123,288	118,488	55,513	119,740
[illegible]	Big Game Hunting	[illegible]	[illegible]	[illegible]	102,638	48,126	117,261	105,681	52,646	114,496
	Small Game Hunting	[illegible]	.064	.131	102,638	48,126	117,261	105,681	52,646	114,496
	Migratory Bird Hunting	[illegible]	.088	.188	102,638	48,126	117,261	105,681	52,646	114,496
	Waterfowl Hunting	[illegible]	[illegible]	.383	102,638	48,126	117,261	105,681	52,646	114,496
[illegible]	Big Game Hunting	[illegible]	[illegible]	.000	9[illegible],140	45,315	111,528	94,433	49,944	109,508
	Small Game Hunting	[illegible]	.064	.131	9[illegible],140	45,315	111,528	94,433	49,944	109,508
	Migratory Bird Hunting	[illegible]	.088	.188	9[illegible],140	45,315	111,528	94,433	49,944	109,508
	Waterfowl Hunting	[illegible]	[illegible]	.383	[illegible]	[illegible]	111,528	94,433	[illegible]	109,508
[illegible]	Big Game Hunting	[illegible]	[illegible]	[illegible]	79,162	42,618	106,075	84,555	47,400	104,763
	Small Game Hunting	[illegible]	[illegible]	.131	79,162	42,618	106,075	84,555	47,400	104,763
	Migratory Bird Hunting	[illegible]	.088	.188	79,162	42,618	106,075	84,555	47,400	104,763
	Waterfowl Hunting	[illegible]	[illegible]	.383	79,162	42,618	106,075	84,555	47,400	104,763
[illegible]	Big Game Hunting	[illegible]	.029	[illegible]	69,525	40,177	100,889	75,880	45,001	100,251
	Small Game Hunting	[illegible]	.064	.131	69,525	40,177	100,889	75,880	45,001	100,251
	Migratory Bird Hunting	[illegible]	.088	.188	69,525	40,177	100,889	75,880	45,001	100,251
	Waterfowl Hunting	[illegible]	.088	.383	69,525	40,177	100,889	75,880	45,001	100,251

Year	Activity	Man Days of Supply Without Project: WS	F/IM	BM	TOTAL	Man Days of Supply With Project: WS	F/IM	BM	TOTAL
[illegible]	Big Game Hunting	20,2[illegible]	1,692	0	21,9[illegible]	2[illegible]	1,692	[illegible]	[illegible]
	Small Game Hunting	132,492	9,569	18,034	160,095	132,492	9,569	18,[illegible]	[illegible]
	Migratory Bird Hunting	0	10,969	25,880	36,849	[illegible]	10,969	25,880	[illegible]
	Waterfowl Hunting	2,088	28,473	52,72[illegible]	83,68[illegible]	2,088	28,473	52,725	[illegible]
[illegible]	Big Game Hunting	17,2[illegible]	1,5[illegible]	0	18,873	17,299	1,574	[illegible]	18,[illegible]
	Small Game Hunting	11[illegible]	8,902	16,981	139,25[illegible]	113,32[illegible]	8,902	16,981	139,[illegible]
	Migratory Bird Hunting	0	10,2[illegible]	24,370	34,575	[illegible]	10,2[illegible]	24,370	34,5[illegible]
	Waterfowl Hunting	2,129	26,440	49,647	78,2[illegible]	2,129	26,440	49,647	78,2[illegible]
[illegible]	Big Game Hunting	15,193	1,482	0	16,6[illegible]	15,403	1,610	[illegible]	17,013
	Small Game Hunting	99,572	8,382	16,152	124,[illegible]	100,952	9,104	15,888	12[illegible],242
	Migratory Bird Hunting	[illegible]	9,609	23,178	32,78[illegible]	[illegible]	10,436	22,511	32,947
	Waterfowl Hunting	1,870	24,942	47,219	74,0[illegible]	1,898	27,090	45,860	74,8[illegible]
[illegible]	Big Game Hunting	13,343	1,396	0	14,739	13,739	1,526	0	15,265
	Small Game Hunting	87,448	7,893	17,361	11[illegible],702	90,[illegible]	8,674	14,999	113,673
	Migratory Bird Hunting	0	9,148	22,245	31,393	0	9,897	21,525	31,422
	Waterfowl Hunting	1,642	23,485	44,911	[illegible]	1,691	25,691	43,852	[illegible]
[illegible]	Big Game Hunting	11,718	1,314	0	13,032	12,27[illegible]	1,448	0	13,72[illegible]
	Small Game Hunting	76,799	7,432	14,61[illegible]	98,84[illegible]	80,452	8,191	14,346	102,944
	Migratory Bird Hunting	0	8,519	20,967	29,48[illegible]	0	9,389	20,588	29,977
	Waterfowl Hunting	1,442	22,114	42,715	66,271	1,5[illegible]	24,373	41,942	67,82[illegible]
[illegible]	Big Game Hunting	10,291	1,236	0	11,527	10,992	1,375	0	12,367
	Small Game Hunting	67,448	6,989	13,898	88,33[illegible]	72,041	7,774	13,724	93,539
	Migratory Bird Hunting	0	8,012	19,942	27,95[illegible]	[illegible]	8,911	19,695	28,6[illegible]
	Waterfowl Hunting	1,267	20,798	40,62[illegible]	62,692	1,353	23,131	40,124	64,608
[illegible]	Big Game Hunting	9,038	1,165	0	10,203	9,864	1,305	0	11,169
	Small Game Hunting	59,235	6,589	13,216	79,0[illegible]	[illegible]	7,386	13,133	85,163
	Migratory Bird Hunting	0	7,5[illegible]	18,947	26,52[illegible]	[illegible]	8,460	18,847	27,307
	Waterfowl Hunting	1,112	19,606	38,64[illegible]	59,358	1,214	21,960	38,396	61,570

- With-project conditions: 3,707 picnic tables x 7.7 user days/table x 91.5 ÷ .507 = 5,151,414 annual user days = 5,151,400 annual user days (rounded)

HUNTING USE

G.4.16. To calculate hunting man-days available in the future, the various marsh habitats were projected for the life of the project for the with- and without-project conditions. Each habitat type was multiplied by its carrying capacity for the specific activity measured, then totaled to yield the projected annual man-days of use. This data is shown on table G-4-1.

G.4.17. The habitat types measured were restricted to those that would be affected by the project. Bottomland hardwoods were eliminated from the calculations because project impacts will neither affect their destruction nor preservation. As no net land use changes would occur in the Mississippi area as a result of project implementation, Mississippi habitat analysis was excluded from this discussion as well as from tables G-4-1, G-4-2, and G-4-3.

RECREATION VALUATIONS

G.4.18. The Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies describe several different methodologies for evaluating recreation benefits. The preferred means to forecast use is to use regional or site specific use estimating models that employ the travel cost method or contingent value method to derive recreational valuations. However, the use of either of these methods depends on sufficient base data. No regional use estimating model exists for any area of Louisiana, nor is there a site specific use estimator model (UEM) for this study. Available data on

o The Mississippi Sound should exhibit increased demands on its fishing resources, warranting the development of additional access.

G.4.15. Following the capacity method of determing use, annual fishing attendance calculations for the with- and without-project conditions are displayed as follows:

o Without-project conditions: 202 boat lanes x 50 user days/lane x 91.5 ÷ .507 = 1,822,781 annual user days = 1,822,800 annual user days (rounded)

o With-project conditions: 214 boat lanes x 50 user days/lane x 91.5 ÷ .507 = 1,931,065 annual user days = 1,931,100 annual user days (rounded)

Annual user days of fishing were not prorated between fresh and saltwater fishing because both activities use the same facilities and have the same valuations.

PICNICKING USE

G.4.15. The development of small picnic areas would be associated with the proposed boat launching areas. Although secondary to the recreation use of boat launching areas, picnicking facilities would sustain a use level that warrants their inclusion in the annual visitation calculations. Following the same use determination procedure as used for fishing, annual picnicking attendance calculations are as follows:

o Without-project conditions: 3,677 picnic tables x 7.7 user days/table x 91.5 ÷ .507 = 5,109,725 annual user days = 5,109,700 annual user days (rounded)

on the sport fishery resource would vary and remain highly dependent on the time, frequency, volume, and duration of diversions, but the fishing potential and use of the overall study area is not expected to be threatened if the proposed project is implemented.

G.4.13. As previously explained, use estimates were based on the capacity use method for boat fishing. This use is predicated on boat launching access that defines and constrains the amount of fishing use. Use would remain constant under the with- and without-project conditions since demand is greater than supply. As the saltwater fishing decreases in the western areas of Lake Pontchartrain, freshwater fishing would increase. This transfer or use change would, in effect, lower the freshwater fishing need but raise the saltwater fishing need.

G.4.14. Although existing resources and facilities would sustain equal use with the project, a potential exists for recreation development, notably boat launching areas. The reasoning for this is:

o Both freshwater and saltwater fishing are in need of additional access facilities as reflected in the demand-need analysis.

o Freshwater potential would expand into areas formerly used by saltwater fishing. This potential, however, would not only be expanded but its quality would be maintained with the renourishment of the marsh and swamp areas. The primary areas of this benefit, the extreme western edges of Lake Pontchartrain, should experience increased demand and need for additional launching.

o Eastern Lake Pontchartrain should exhibit increased demands for additional access facilities as saltwater fishing use moves east. Such a transfer would place additional strain on the existing facilities that are in short supply.

FISHING USE

G.4.10. The major activity affected by the proposed project would be fishing. The extent of the effect is difficult to assess or quantify due to the nature of the project. If the proposed project is implemented, saltwater fish and shrimp that are found seasonally in many areas of Lake Pontchartrain would be confined to the extreme eastern portions of the lake during years of freshwater diversion. The altered state of the lake would not destroy recreational fishing, but would transfer the potential for saltwater fishing to the east. The remaining freshwater areas would support an expanded freshwater fishery.

G.4.11. The shortage or need measurements indicate a potential use far in excess of current or forecasted levels for both fresh and saltwater fishing. The existing potential is not destroyed when transferred, but retains its capability to accommodate the same level of usage. Areas that formerly supported saltwater fishing would be altered during years of freshwater diversion to support freshwater fishing, an activity that sustains an excess demand over the available supply.

G.4.12. The proposed freshwater diversion would not decrease the quantity of the fishing potential. More pronounced effects are likely to occur in isolated locales, but the overall effects would not be detrimental to the system. The western portion of Lake Pontchartrain is primarily a freshwater fishing area at present. Freshwater diversion that benefits the marsh and swamp areas should benefit the freshwater fishing and expand its availability. Similar results should occur in the St. Charles Parish marsh. To the east, the Rigolets, Chef Menteur Pass, and eastern Lake Pontchartrain should retain the saltwater fishing resource currently available. The Mississippi Sound area should not be impaired by diversions. The establishment of oyster reefs in that area should serve to improve the fishing potential. The magnitude of impacts

the project is implemented as they, also, do not depend on salinity regimes. Marsh and wooded swamp areas that have suffered due to saltwater intrusion would benefit from the introduction of fresh water as would related hunting activities. As a result of the project effects on marsh and wooded swamp areas, hunting activities would be affected and because recreation development is a project feature, fishing and picnicking activities would also be affected.

G.4.7. Fishing and picnicking visitations were calculated by a different method than that used for hunting.

G.4.8. To determine annual use for fishing and picnicking, the optimal use standards for boat lanes and picnic tables presented in Column 7 of table G-2-4 were multiplied by the number of existing facilities to determine the daily facility design capacities. The design capacities were then multiplied by 91.5 high-quarter days to measure optimal use in that period of the year where it would most likely approach the facility design capacity. By determining high-quarter use, annual attendance could be calculated by expanding high-quarter use over the remaining three quarters of the year.

G.4.9. In the Outdoor Recreation Resources Review Commission (ORRRC) Study Report No. 19, page 363, the percentage of annual recreation outings occurring in the summer high-use quarter was analyzed to yield a conversion factor of 50.7 percent for active recreational pursuits. Activities such as sightseeing for which no unit standard has been developed were excluded. By applying this 50.7 percent conversion factor, the high-quarter use for fishing and picnicking can be annualized.

fishing, and picnicking activities in the market area. When this condition is present, it is assumed that each existing facility or acre is being used to its optimal capacity: every boat lane or picnic table consistently sustains the level of use stated by the standard and every acre of habitat is used for each hunting activity at a level equal to its optimal biological carrying capacity based on a sustained yield harvest. Therefore, every increment or decrement of the supply would correspondingly increase or decrease the associated level of use.

G.4.5. Measuring annual attendance in the previously stated manner is consistent with the Capacity Method of Determining Use as presented in Chapter II, Section VIII, Paragraph 2.8.9(b)(4) of the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementations Studies, 10 March 1983. Using this method, recreational use is held constant over time. Therefore, future use projections would not differ from initial use projections unless the existing facility or acre is altered from its present state. Using this method, the annual use and valuations for the study area can be projected and compared for the with- and without-project conditions with the proposed recreational development in place.

G.4.6. Visitation calculations for the study and subsequent valuations have been determined for those activities (fishing and picnicking) that are to be provided for under the recreation development plan and for those hunting activities that will be directly affected by the proposed freshwater diversion. Though project implementation will affect recreation in the study area, many popular recreational activities would not be measurably affected. Boating, sailing, windsurfing, and waterskiing are water-based activities that do not depend on salinity regimes and they should not be impaired. Land-based activities, even those occurring along lakefronts or shorelines such as camping, bicycling, sightseeing, hiking, etc., are not expected to be affected if

Section 4. RECREATIONAL VISITATIONS AND VALUATIONS

DETERMINATION OF ANNUAL USE

G.4.1. Recreational resources of the study area are viewed as beneficiaries of freshwater diversion. Identifying and quantifying those benefits proved to be difficult tasks because traditional valuation methods could not be used.

G.4.2. There are no valid data available that measure actual use of the study area. Recommended methods including site specific use-estimating models, similar projects techniques, and regional use models could not be adapted for this study. There are numerous reasons why these methods could not be applied but the primary reason is that the study area is not site specific. Most traditional recreation evaluations employ site specific studies to determine use at a project. The only existing study from which use data could be extracted is the 1974 Fish and Wildlife Study of the Louisiana Coastal Area and Atchafalaya Basin Floodway. Unfortunately, the report is dated and, while some user survey information such as distance to site is presented, the information is statistically unreliable at the basin level. In addition, user information is not presented in a manner that allows per capita use rates to be derived.

G.4.3. Most recreational evaluation techniques rely on the creation, through development, of new and additional recreation opportunities for public consumption or use (that is, new parks, campgrounds, fishing areas) on which benefits can be measured and quantified.

G.4.4. The recreational demand-needs analysis determined that a large need exists for additional opportunities and facilities for hunting,

G.3.24. For the life of the project, the non-Federal entity must operate, maintain, and replace the recreational areas and all installed facilities without expense to the Federal Government. Additionally, recreational developments participated in by the Corps must be available for the general public use on an equal basis.

G.3.25. Local cooperation requirements for all project features including recreation are presented in detail in the Main Report and Appendix B, Plan Formulation.

G.3.26. The distribution of recreation cost between the Federal Government and the non-Federal sponsors as shown below:

	Non-Federal Sponsors		
Federal	Louisiana	Mississippi	Total
$371,300	$249,600	$121,800	$742,700

COST-SHARING REQUIREMENTS

G.3.21. For the purposes of determining Federal/local sponsor cost-sharing responsibilities, the Mississippi and Louisiana Estuarine Areas study should conform to traditional policies and guidelines, the President's Cost-Sharing Policy, and the provisions of the Federal Water Project Recreation Act of 1965 (PL 89-72) that require beneficiaries to bear part of the costs of installing and all the cost for managing recreational developments at Federal water resources projects.

G.3.22. Cost-sharing provisions require that non-Federal public entities agree in a letter of intent to participate in the recreation development, that non-Federal entities provide fee title to all additional lands other than access roads required for the development and control of the recreation areas, and that the acquisition of such lands be credited towards the non-Federal sponsors' 50-percent share of recreation development costs. Where the appraised value of the additional recreation lands amounts to less than 50 percent of the total first cost of recreation development, the non-Federal sponsor must make additional contributions sufficient to bring the non-Federal share to the 50-percent level. This additional contribution may consist of the actual cost of carrying out an agreed-upon portion of the development, a cash contribution at the time of construction, or a combination of both.

G.3.23. For the Bonnet Carre' Spillway, no real estate considerations would be necessary as the proposed recreation site would be developed on Federally-owned land. However, non-Federal O&M requirements would apply for the life of the project.

shows the computations for annual visitation and dollar benefits for the recommended recreational development features.

BENEFITS-COST COMPARISON

G.3.19. For the recommended recreation development features, the following benefit-cost computation is applicable:

Total first cost of construction:	$742,680
Gross investment:	771,923
Interest & amortization factor: (50 year, 8 1/8 percent)	.08292
Annual interest & amortization:	$ 64,008
Annual interest & amortization:	64,008
Annual operations & maintenance costs:	14,010
Total annual costs:	$ 78,017
	($ 78,000) rounded

$$\frac{\text{Annual Benefits}}{\text{Annual Costs}} \quad \frac{\$\ 613{,}000}{\$\ \ 78{,}000} = 7.9 \text{ to } 1$$

The benefit-cost ratio of the proposed recreational development features of the recommended plan is 7.9 to 1.

G.3.20. The benefits used in the computation of the benefit-cost ratio are only those attributable to the proposed recreational development plan. Other net recreation benefits that occur as a result of project-induced terrestrial habitat preservation were not included in the calculation. These other net recreation benefits have been identified and monetarily evaluated in Section 5 of this appendix and are used in computing the benefit-cost ratio for the overall project.

TABLE G-3-3

MISSISSIPPI AND LOUISIANA ESTUARINE AREA

Proposed Recreation Development Plan
Annual Visitation and Dollar Benefit Calculations

Activity Type	Number of Facilities	Users per Facility	Turnover Rate Per Day	Facility Design Capabilities in Activity Occasions	High Quarter Factor (91.5)	Activity Annualization Factor (.507)	Total Annual Visitation	Unit Day Value $	Total Annual Dollar Benefits
Boat Fishing	12 Lanes	2.50	20	600	54,900	108,284	108,300	4.2	455,000
Picnicking	30 Tables	3.85	2	231	21,137	41,690	41,700	3.8	158,000
TOTAL							150,000		613,000

TABLE G-3-2

MISSISSIPPI AND LOUISIANA ESTUARINE AREAS

Proposed Recreation Development Plan
Cost Estimate Summary

Site Name	Development Cost	25% Contingencies	Net Total	10%1/ E&D	9%2/ S&A	Subtotal	Real4/ Estate	Total	Annual O&M 3/ & Replacement (2% of Subtotal)
Bonnet Carre' Spillway	78,500	19,635	98,135	9,814	8,832	116,780	0	116,780	2,335
Frenier Beach	78,500	19,635	98,135	9,814	8,832	116,780	22,000	138,780	2,335
The Rigolets	78,500	19,635	98,135	9,814	8,832	116,780	6,000	122,780	2,335
Pointe Aux Herbes	78,500	19,635	98,135	9,814	8,832	116,780	4,000	120,780	2,335
Cedar Point	78,500	19,635	98,135	9,814	8,832	116,780	6,000	122,780	2,335
Wolf River	78,500	19,635	98,135	9,814	8,832	116,780	4,000	120,780	2,335
TOTALS						700,680	42,000	742,680	14,010

1/Engineering & Design
2/Supervision & Administration
3/Operation & Maintenance
4/Based on 2 Acres/Site Acquired in Fee Simple Estate

G.4.22. With identical values, fresh and saltwater fishing were no longer considered as separate activities. The proposed project with varying diversion flows precluded exact delineation between these two activities. Since both activities use identical facilities and have identical valuations, further separation was considered superfluous.

G.4.23. Project-related recreational activities were weighed against a suggested rating table provided in WRC Principles and Guidelines that measures recreation activities offered, available opportunity, carrying capacity, ease of access, and environmental quality. Of a maximum score of 100, the measured activities received 60, which corresponded to Unit Day Values of $3.80 for picnicking, $4.20 for each general hunting and fishing activity, and $15.10 for each specialized hunting activity.

HUNTING VALUATIONS

G.4.24. The annual man-day supply of each hunting activity was multipled by its associated unit day value to determine annual dollar values for the with- and without-project conditions for each 10-year increment as shown in table G-4-2. The unit day values were held constant over time because the individual hunting potential of each acre of habitat was not impaired over time. Any acre of fresh marsh has the same potential harvest rate in 1990 as it would in 2040. The number of acres of each habitat is affected. As the acres of habitat decrease over time, the associated man-days of available use would correspondingly decrease. In addition, some habitat types may shift from one type to another. As these shifts occur, some hunting activities may increase and other types of hunting activities may decrease.

TABLE C-4-2

HUNTING VALUATIONS WITH AND WITHOUT PROJECT

LOUISIANA ESTUARINE AREA

Activity	Unit Day Value	Man-days Supply Without Project	Value Without Project	Man-days Supply With Project	Value With Project
		1978			
Big Game Hunting	15.10	21,908	330,811	21,908	330,811
Small Game Hunting	4.20	160,095	672,399	160,095	672,399
Migratory Bird Hunting	4.20	36,849	154,766	36,849	154,766
Waterfowl Hunting	15.10	83,686	1,263,659	83,686	1,263,659
		302,538	2,421,635	302,538	2,421,635
		1990			
Big Game Hunting	15.10	18,873	284,982	18,873	284,982
Small Game Hunting	4.20	139,259	584,888	139,259	584,888
Migratory Bird Hunting	4.20	34,575	145,215	34,575	145,215
Waterfowl Hunting	15.10	78,266	1,181,817	78,266	1,181,817
		270,973	2,196,902	270,973	2,196,902
		2000			
Big Game Hunting	15.10	16,675	251,793	17,013	256,896
Small Game Hunting	4.20	124,105	521,241	125,742	528,116
Migratory Bird Hunting	4.20	32,787	137,705	32,947	138,377
Waterfowl Hunting	15.10	74,031	1,117,868	74,846	1,130,175
		247,598	2,028,607	250,548	2,053,564
		2010			
Big Game Hunting	15.10	14,739	222,559	15,265	230,502
Small Game Hunting	4.20	110,702	464,948	113,673	477,427
Migratory Bird Hunting	4.20	31,093	130,591	31,422	131,972
Waterfowl Hunting	15.10	70,038	1,057,574	71,234	1,075,633
		226,572	1,875,672	231,594	1,915,534
		2020			
Big Game Hunting	15.10	13,032	196,783	13,724	200,437
Small Game Hunting	4.20	98,841	415,132	102,994	432,575
Migratory Bird Hunting	4.20	29,486	123,841	29,977	125,903
Waterfowl Hunting	15.10	66,271	1,000,692	67,826	1,024,173
		207,630	1,736,448	214,521	1,783,088
		2030			
Big Game Hunting	15.10	11,527	174,058	12,367	186,742
Small Game Hunting	4.20	88,333	370,[illegible]	93,539	392,864
Migratory Bird Hunting	4.20	27,954	117,407	28,606	120,145
Waterfowl Hunting	15.10	62,692	946,649	64,608	975,581
		190,506	1,609,113	199,120	1,675,332
		2040			
Big Game Hunting	15.10	10,203	154,065	11,169	168,652
Small Game Hunting	4.20	79,040	331,968	85,163	357,685
Migratory Bird Hunting	4.20	26,520	111,384	27,307	114,689
Waterfowl Hunting	15.10	59,358	896,306	61,570	929,707
		175,121	1,493,723	185,209	1,570,733

FISHING AND PICNICKING VALUATIONS

G.4.25. Annual fishing and picnicking values were calculated in a manner similar to hunting values. Annual use was multiplied by the unit day value for the with- and without-project conditions to determine annual valuations. Differences in annual with- and without-project fishing and picnicking valuations are due solely to the increased use provided by the recreation development plan. In the absence of the recreational development plan, fishing and picnicking use and valuations for the with-project conditions would be identical and equal to the without-project conditions. Annual valuations for fishing and picnicking are given as follows:

- Fishing

  Without-project conditions: 1,822,800 annual user days x
  $4.20 unit day value = $7,655,760 annual value
  = $7,656,000 annual value (rounded)

  With-project conditions: 1,931,100 annual user days x
  $4.20 unit day value = $8,110,620 annual value
  = 8,111,000 annual value (rounded)

- Picnicking

  Without-project conditions: 5,109,700 annual user days x
  $3.80 unit day value = $19,416,860 annual value
  $19,417,000 = annual value (rounded)

  With-project conditions: 5,151,400 annual user days x
  $3.80 unit day value = $19,575,320 annual value
  = $19,575,000 annual value (rounded)

TOTAL VALUATIONS

G.4.26. Total recreation valuations were obtained by adding together the annual fishing, picnicking, and hunting values. Table G-4-3 shows, in summary, the total man-days and values of these activities for each 10-year increment for the with- and without-project conditions. Benefits are obtained by subtracting the future without-project values from the future with-project values.

TABLE G-4-3

TOTAL RECREATION USE AND VALUE

MISSISSIPPI AND LOUISIANA ESTUARINE AREA

Activity	Man-days Without Project	Dollar Value Without Project	Man-days With Project	Dollar Value With Project
		1978		
Hunting	302,538	2,421,635	302,538	2,421,635
Fishing	1,822,800	7,656,000	1,822,800	7,656,000
Picnicking	5,109,700	19,417,000	5,109,700	19,417,000
TOTAL	7,235,038	29,494,635	7,235,038	29,494,635
		1990		
Hunting	270,973	2,196,902	270,973	2,196,902
Fishing	1,822,800	7,656,000	1,931,100	8,111,000
Picnicking	5,109,700	19,417,000	5,151,400	19,575,000
TOTAL	7,203,473	29,269,902	7,353,473	29,882,902
		2000		
Hunting	247,598	2,028,607	250,548	2,053,564
Fishing	1,822,800	7,656,000	1,931,100	8,111,000
Picnicking	5,109,700	19,417,000	5,151,400	19,575,000
TOTAL	7,180,098	29,101,607	7,333,048	29,739,564
		2010		
Hunting	226,572	1,875,672	231,594	1,915,534
Fishing	1,822,800	7,656,000	1,931,100	8,111,000
Picnicking	5,109,700	19,417,000	5,151,400	19,575,000
TOTAL	6,955,152	28,948,672	7,314,094	29,601,534
		2020		
Hunting	207,630	1,736,448	214,521	1,783,088
Fishing	1,822,800	7,656,000	1,931,100	8,111,000
Picnicking	5,109,700	19,417,000	5,151,400	19,575,000
TOTAL	7,140,130	28,809,448	7,297,021	29,469,088
		2030		
Hunting	190,506	1,609,113	199,120	1,675,332
Fishing	1,822,800	7,656,000	1,931,100	8,111,000
Picnicking	5,109,700	19,417,000	5,151,400	19,575,000
TOTAL	7,123,006	28,682,113	7,281,620	29,361,332
		2040		
Hunting	175,121	1,493,723	185,209	1,570,733
Fishing	1,822,800	7,656,000	1,931,100	8,111,000
Picnicking	5,109,700	19,417,000	5,151,400	19,575,000
TOTAL	7,107,621	28,566,723	7,267,709	29,256,733

Section 5. PLAN IMPACT ASSESSMENT

CONSTRUCTION IMPACTS

G.5.1. Construction of the proposed freshwater diversion structure, diversion channel, and appurtenances in the Bonnet Carre' Spillway would necessitate clearing 1,811 acres, including areas designated for dredged material disposal.

G.5.2. Most recreational pursuits would not be permanently impaired by the construction activities. There would be some temporary and short term interruptions, deterrents, and obstructions to use during the construction period. However, these impacts should abate and a full recovery of recreational uses should ensue within a short time frame.

G.5.3. Hunting activities would be permanently affected as the destroyed habitat types are not predicted to recover over the project life. The acreage of the habitat types affected by construction include 618 acres of wooded swamp, 56 acres of scrub shrub, 1,074 acres of developed land, and 63 acres of water. Of the affected habitat types, only the wooded swamp acreage is of enough significance to quantify. Annual man-days of hunting and the associated dollar losses from construction impacts have been determined for the wooded swamp acreage as follows:

Hunting Type	Man-day Capacity/ Acre	Acreage Destroyed	Man-days Lost	Unit Day Value $	Annual Hunting Value Lost
Big Game	.130	618	80	15.10	1208
Small Game	.848	618	524	4.20	2,201
Migratory	.000	618	-	4.20	-
Waterfowl	.053	618	33	15.10	498
TOTAL			637 Man-Days		3907

G.5.4 The annual hunting loss of 637 man-days would remain a constant annual loss thoughout the project life. These hunting losses are not attributable to the recreational features of the proposed project. As such, they are not measured against the recreational development plan's incremental benefit-cost calculations presented in Section 3 of this appendix. These losses are taken into account in the overall project benefit-cost calculations as detailed in Appendix F, Economics. Losses resulting from construction of the six 2-acre recreation development sites are considered to be of minor significance.

WITH- AND WITHOUT-PROJECT BENEFIT COMPARISON

G.5.5. Other than the hunting losses due to construction, the proposed Mississippi and Lousiana Estuarine Areas project would not cause any discernable adverse impacts on the existing recreational resources of the study area. With the recreational development plan incorporated as an integral project feature, the future with-project conditions would increase recreational use over the future without-project conditions. When compared with the future without-project conditions, the future with-project conditions reflect a net annual increase of 160,088 annual man-days valued at $690,000 by the year 2040 (exclusive of the development costs).

St. Bernard Parish Planning Commission

8201 W. Judge Perez Drive
Chalmette, La. 70043
Telephone 277-6371

February 27, 1984

Colonel Robert C. Lee,
District Engineer
New Orleans District
Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160

RE: Mississippi Louisiana
Estuarine Study

Dear Colonel Lee:

Enclosed is a resolution unanimously adopted by the Police Jury and recommended by the St. Bernard Parish Coastal Advisory Committee to consider a recreational site in St. Bernard Parish under the above referenced study. Also included is preliminary information on the recreation potential at Fort Proctor. The Police Jury is currently working to stabilize the Fort, which is in danger of becoming completely severed from the land because of erosion. Recreational opportunities would complement our efforts to preserve the Fort and provide access for the public to appreciate both an important historical asset and the valuable fishery resources in Lake Borgne.

We appreciate your consideration and would be pleased to provide additional information if needed. Should questions arise, please contact Margaret Balzer of my staff.

Sincerely,

JACK A. STEPHENS
DIRECTOR/SECRETARY

JAS:MEB/rcb

enclosure

Police Jury
St. Bernard Parish
8201 W. Judge Perez Drive
Chalmette, La. 70043
Telephone 277-6371

EXTRACT OF THE OFFICIAL PROCEEDINGS OF THE POLICE JURY OF THE PARISH OF ST. BERNARD, STATE OF LOUISIANA, TAKEN AT A REGULAR MEETING HELD AT CHALMETTE, LOUISIANA, IN THE POLICE JURY CHAMBERS ON TUESDAY, FEBRUARY 7, 1984 AT ELEVEN O'CLOCK A.M.

On motion of Mr. Rodriguez, seconded by Mr. Cannizaro, it was moved to adopt the following resolution:

RESOLUTION #11-84

WHEREAS, The Mississippi-Louisiana Estuarine Study provides for six recreational sites to increase public access to water dependent recreation; and

WHEREAS, The diversion of fresh water in the vicinity of the Bonne Carre Spillway will, according to the Corps of Engineers, significantly increase fishery production in Lake Borgne and thereby increase recreational opportunities; and

WHEREAS, the plans developed for the stabilization of Fort Proctor include some preliminary ideas for recreational development; and

WHEREAS, the Corps of Engineers did not investigate or tentatively select a site in St. Bernard Parish;

NOW THEREFORE BE IT RESOLVED that the St. Bernard Parish Police Jury does hereby request that the Corps of Engineers evalaute and incorporate Fort Proctor as a recreational site in the Mississippi-Louisiana Estuarine Study;

FURTHER BE IT RESOLVED that if the Fort Proctor Site is inappropriate other recreation sites be investigated within St. Bernard Parish.

The above and foregoing having been submitted to a vote, the vote thereupon resulted as follows:

YEAS: Messrs: Guillot, Haggerty, Cannizaro,
Gorbaty, Cusimano, Munster,
Licciardi, Landry, Henderson
and Rodriguez.

NAYS: None.

ABSENT: None.

And the motion was declared adopted on the 7th day of February 1984.

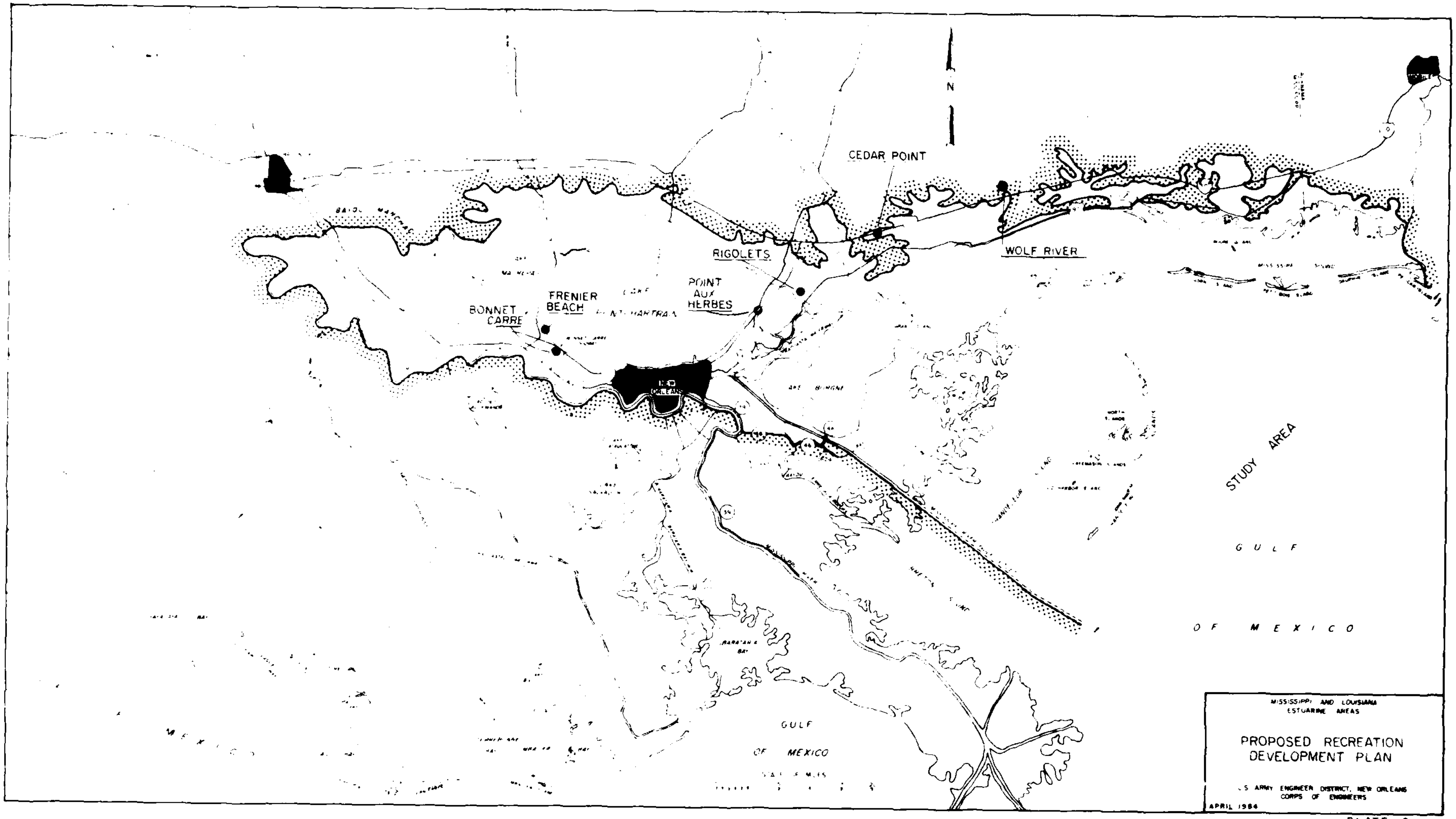
C E R T I F I C A T E

I HEREBY CERTIFY that the above and foregoing is a true and correct copy of a motion adopted at a regular meeting of the Police Jury held at Chalmette, Louisiana on the 7th day of February, 1984.

Witness my hand and the seal
of the Parish of St. Bernard
on the 8th day of February, 1984.

Stephen W. Price

STEPHEN W. PRICE
SECRETARY/TREASURER



N
CEDAR POINT
WOLF RIVER
RIGOLETS
POINT AUX HERBES
FRENIER BEACH
BONNET CARRE
STUDY AREA
GULF OF MEXICO
GULF OF MEXICO
MISSISSIPPI AND LOUISIANA ESTUARINE AREAS
PROPOSED RECREATION DEVELOPMENT PLAN
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS
APRIL 1984

PLATE G-3-1

APPENDIX H

WATER QUALITY

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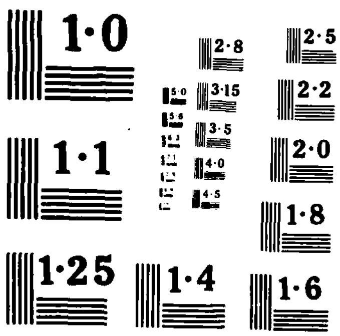

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MISSISSIPPI - LOUISIANA ESTUARINE AREAS STUDY

Report on Freshwater Diversion to the Lake Ponchartrain Basin and Mississippi Sound

Appendix H

W A T E R Q U A L I T Y

H.0.1. This appendix presents a description, a comparison, and an evaluation of existing water quality in a segment of the Mississippi River near New Orleans and in two adjacent estuarine areas - the Lake Pontchartrain Basin and the west Mississippi Sound. Additionally, information related to the general quality of selected water bodies located in the Mississippi Coastal River and Pascagoula River Basins is presented. Applicable standards and criteria are used to gage existing water quality in these areas. The comparative evaluation of existing water quality provides a basis for identifying potential water quality - related impacts associated with diverting Mississippi River waters enhance wildlife and fisheries resources in the Lake Pontchartrain Basin and west Mississippi Sound areas.

H.0.2. The monthly probability distributions of key water quality parameter levels in the Mississippi River and estimated supplemental discharge requirements provide a measure of parameter loading rates that might be realized during freshwater diversion periods. Parameter loading rate estimates and an assessment of background conditions in the primary receiving estuarine areas are used to estimate water quality-related impacts of the proposed freshwater diversion.

SECTION 1. WATER QUALITY STANDARDS AND CRITERIA

H.1.1. The Louisiana Environmental Control Commission* (LECC) and the Mississippi Department of Natural Resources-Bureau of Pollution Control have published standards and the US Environmental Protection Agency (EPA) has established ambient water quality criteria that are applicable to surface waters in the study area.

APPLICABLE LOUISIANA STATE STANDARDS

H.1.2. The LECC has established general descriptive water quality standards that apply to all waters in the State of Louisiana. The general descriptive standards relate to the condition of the water as affected by waste discharges or human activity as opposed to purely natural phenomena.

DESCRIPTIVE WATER QUALITY STANDARDS

H.1.3. Floating, Suspended, and Settleable Solids. There shall be no substances present in concentration sufficient to produce distinctly visible turbidity, solids or scum, nor shall there be any formation of slimes, bottom deposits, or sludge banks attributable to waste discharges from municipal, industrial, or other sources including agricultural practices.

H.1.4. Settleable and suspended solids shall not reduce the depth of the compensation point for photosynthetic activity by more than 10 percent from the seasonally established norm for aquatic life.

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* Formerly the Louisiana Stream Control Commission

H.1.5. Taste and Odor. Taste- and odor-producing substances shall be limited to conentrations that will not interfere with the production of potable water by reasonable water treatment methods, or impact unpalatable flavor to food fish, including shellfish, or result in offensive odors arising from the waters, or otherwise interfere with the reasonable use of the waters.

H.1.6. Toxic Substances. There shall not be substances present in quantities that alone or in combination will be toxic to animal or plant life. In all cases, the level shall not exceed 10 percent of the 96-hour median tolerance limit. Biossay techniques will be used in evaluation toxicity utilizing methods and species of test organisms suitable to the purpose at hand. In cases where the stream is used as a public water supply, the level of toxic substances shall not exceed the levels established by the latest edition of US Public Health Service drinking water standards.

H.1.7. Oils and Greases. There shall be no free or floating oil or grease present in sufficient quantities to interfere with the designated uses, nor shall emulsified oils be present in sufficient quantities to interfere with the designated uses.

H.1.8. Foaming or Frothing Materials. There shall be none of a presistent nature.

H.1.9. Nutrients. The naturally-occurring nitrogen-phosphorus ratio shall be maintained. On completion of detailed studies on the naturally-occurring levels of the various macro- and micronutrients, the state will establish numerical limits on nutrients where possible.

H.1.10. Turbidity. There shall be no substantial increase in turbidity from ambient conditions due to waste discharges.

H.1.11. Esthetics. The waters of the state shall be maintained in an esthetically attractive condition and shall meet the generally accepted esthetic qualifications. All waters shall be free from such concentrations of substances attributable to wastewater or other discharges sufficient to:

- o settle to form objectionable deposits.
- o float as debris, scum, oil, or other matter to form nuisances.
- o result in objectionable color, odor, taste, or turbidity.
- o injure or be toxic to or produce adverse physiological response in humans, animals, fish, shellfish, wildlife, or plants.
- o produce undesirable or nuisance aquatic life.

H.1.12. Other Material. Limits on other substances not specified in these water quality standards shall be in accord with recommendations set by the LECC or the Louisiana Department of Health and Human Resources Administration for municipal raw water sources.

NUMERICAL WATER QUALITY STANDARDS

H.1.13. LECC has also established numerical standards that apply to specific surface waters of Louisiana as well as their navigable tributaries, distributaries, and ancillary streams and water bodies. The numerical standards apply specifically to substances or conditions attributed to waste discharge or activities of man as opposed to purely natural phenomena. Table H-1-1 lists selected Louisiana surface waters in the study area for which numerical standards have been published. Table H-1-1 also includes designated-use categories for the surface waters listed.

TABLE H-1-2

SELECTED MISSISSIPPI STATE SURFACE WATERS IN THE STUDY AREA
AND WATER USE CLASSIFICATIONS

Waters	From	To	Classification
Pearl River	Byram Bridge	Miss. Sound	Recreation
COASTAL BASIN			
Bangs Lake	Headwaters	Miss. Sound	Shellfish Harvesting
Bayou Cumbest	Headwaters	Miss. Sound	Shellfish Harvesting
Biloxi Bay	Highway 90	Miss. Sound	Shellfish Harvesting
Davis Bayou	Headwaters	Biloxi Bay	Shellfish Harvesting
Graveline Bayou	Graveline Bay	Miss. Sound	Shellfish Harvesting
Jourdan River	Highway 603	St. Louis Bay	Recreation
Mallini Bayou	St. Louis Bay	St. Louis Bay	Shellfish Harvesting
Miss. Sound	Contiguous	Miss. Coastline	Recreation
Pass Christian Reef-Henderson Point			Shellfish Harvesting
St. Louis Bay	Harrison-Hancock Counties		Shellfish Harvesting
PASCAGOULA RIVER BASIN			
Escatawpa River	Mile 10	Pascagoula River	Fish and Wildlife
Pascagoula River	6 Mi. North of MS Hwy. 26 George County	Cumbest Bluff Jackson County	Recreation

H.1.50. Phenolic Compounds. There shall be no substances added which will cause the phenolic content to exceed 0.05 mg/L (phenol).

H.1.51. Dissolved oxygen. Dissolved oxygen concentrations shall be maintained at a daily average of not less than 5 0 mg/L with an instantaneous minimum of not less than 4.0 mg/L in streams, shall be maintained at a daily average of not less than 5.0 mg/L with an instantaneous minimum of not less than 4.0 mg/L in estuaries and in the tidally-affected portions of streams; and shall be maintained at a daily average of not less than 5.0 mg/L with an instantaneous minimum of not less than 4.0 mg/L in the epilimnion for lakes and impoundments that are not stratified.

H.1.52. Selected Mississippi state surface waters in the study area and their designated use classification are listed in table H-1-2.

EPA WATER QUALITY CRITERIA

H.1.53. The EPA has established ambient water quality criteria applicable to surface waters in the study area. Criteria for the protection of aquatic life and its uses are shown in tables H-1-3 and H-1-4. The criteria listed in these tables have been developed for various metals, organics, and inorganics for the protection of freshwater aquatic life, marine and estuarine aquatic life, and public health.

H.1.45. Dissolved oxygen. Dissolved oxygen concentrations shall be maintained at a daily average of not less than 5.0 mg/L with an instantaneous minimum of not less than 4.0 mg/L in streams; shall be maintained at a daily average of not less than 5.0 mg/L with an instantaneous minimum of not less than 4.0 mg/L in estuaries and in the tidally affected portions of streams; and shall be maintained at a daily average of not less than 5.0 mg/L with an instantaneous minimum of not less than 4.0 mg/L in the epilimnion (i.e., the surface layer of lakes and impoundments that are thermally stratified, or five feet from the water's surface or mid-depth if the lake or impoundment is less than 10 feet deep at the point of sampling) for lakes and impoundments that are not stratified.

FISH AND WILDLIFE

H.1.46. Waters in this classification are intended for fishing and for propagation of fish, aquatic life, and wildlife.

H.1.47. Bacteria. Fecal coliform shall not exceed a geometric mean of 2,000/100 mL, nor shall more than ten percent (10%) of the samples examined during any month exceed 4,000/100 mL.

H.1.48. Specific Conductance. There shall be no substance added to increase the conductivity above 1,000 micromhos/cm for freshwater streams.

H.1.49. Dissolved Solids. There shall be no substances added to the waters to cause the dissolved solids to exceed 750 mg/L as a monthly average value, nor exceed 1,500 mg/L at any time for freshwater streams.

instantaneous minimum of not less than 4.0 mg/L in estuaries and in the tidally-affected portions of streams; and shall be maintained at a daily average of not less than 5.0 mg/L with an instantaneous minimum of not less than 4.0 mg/L in the epilimnion [i.e., the surface layer of lakes and impoundments that are thermally stratified or five feet from the water's surface (mid-depth if the lake or impoundment is less than 10 feet deep at the point of sampling) for lakes and impoundments that are not stratified.]

RECREATION

H.1.40. The quality of waters in this classification are to be suitable for recreational purposes, including such water contact activities as swimming and water skiing. The waters shall also be suitable for use for which waters of lower quality will be satisfactory.

H.1.41. In considering the acceptability of a proposed site for disposal of bacterially-related wastewater in or near waters with this classification, the Permit Board shall consider the relative proximity of the discharge to areas of actual water contact activity.

H.1.42. Bacteria. Fecal coliform shall not exceed a geometric mean of 200 per 100 mL nor shall more than ten percent (10%) of the samples examined during any month exceed 400 per 100 mL.

H.1.43. Specific Conductance. There shall be no substances added to increase the conductivity above 1,000 micromhos/cm for freshwater streams.

H.1.44. Dissolved Solids. There shall be no substances added to the water to cause the dissolved solids to exceed 750 mg/L as a monthly average value, nor exceed 1500 mg/L at any time for freshwater streams.

aquatic organisms. Requirements for zones of passage as referenced in Section I (8) of Water Quality Criteria For Intrastate, Interstate and Coastal Waters shall apply. In addition to the general requirements of Section I (2), the temperature shall be measured at a depth of 5 feet in waters 10 feet or greater in depth; and for those waters less than 10 feet in depth, temperature criteria will be applied at mid-depth.

SHELLFISH HARVESTING AREAS

H.1.36. Waters classified for this use are for propagation and harvesting shellfish for sale or use as a food product. These waters shall meet the requirements set forth in the latest edition of the National Shellfish Sanitation Program, Manual of Operations, Part I, Sanitation of Shellfish Growing Areas, as published by the US Public Health Service.

H.1.37. In considering in the acceptability of a proposed site for disposal of bacterially-related wastewater in or near waters with this classification, the Permit Board shall consider the relative proximity of the discharge to shellfish harvesting beds.

H.1.38. Bacteria. The median fecal coliform MPN (Most Probable Number) of the water shall not exceed 14 per 100 mL, and not more than ten percent (10%) of the samples shall ordinarily exceed an MPN of 43 per 100 mL in those portions of areas most probably exposed to fecal contamination during most unfavorable hydrographic and pollutional conditions.

H.1.39. Dissolved Oxygen: Dissolved oxygen concentration shall be maintained at a daily average of not less than 5.0 mg/L with an instantaneous minimum of not less than 4.0 mg/L in streams; shall be maintained at a daily average of not less than 5.0 mg/L with an

limit based on available data. The concentration of toxic pollutants that are cumulative and/or persistent may be further limited on a case-by-case basis.

H.1.33. Available references to be used in determining toxicity limitations shall include, but not be limited to Quality Criteria for Water (Section 304 (a)), Federal Regulations under Section 307, and Federal Regulations under Section 1412 of the Public Health Service Act as amended by the Safe Drinking Water Act (Pub. L. 93-523). The use of such information should be limited to that part applicable to the indigenous aquatic community found in the State of Mississippi.

H.1.34. pH. The normal pH of the waters shall be 6.0 to 8.5 and shall not be caused to vary more than 1.0 unit; however, should the background pH be outside the 6.0 to 8.5 limits, it shall not be changed more than 1.0 unit unless after the change the pH will fall within the 6.0 to 8.5 limits, and the Commission determines that there will be no detrimental effect on stream usage as a result of the greater pH change.

H.1.35. Temperature. The maximum temperature rise above natural temperature shall not exceed 5°F in streams, lakes, and reservoirs nor shall the maximum water temperature exceed 90°F, except that in the Tennessee River the temperature shall not exceed 86°F. In lakes and reservoirs, there shall be no withdrawals from or discharge of heated waters to the hypolimnion unless it can be shown that such discharge will be beneficial to water quality. In all waters, the normal daily and seasonal temperature variations that were present before the addition of artificial heat shall be maintained. The discharge of any heated waste into any coastal or estuarine waters shall not raise temperatures more than 4°F above natural during the period October through May nor more than 1.5°F above natural for the months June through September. There shall be no thermal block to the migration of

H.1.29. Waters shall be free from substances attributable to municipal, industrial, agricultural, or other discharges in concentrations or combinations which are toxic or harmful to humans, animals or other aquatic life.

H.1.30. Municipal wastes, industrial wastes, or other wastes shall receive effective treatment or control in accordance with Sections 301, 306, and 307 of the Federal Water Pollution Control Act Amendments of 1972. A degree of treatment greater than defined in these sections may be required when necessary to protect legitimate water use.

H.1.31. <u>*Dissolved Oxygen.</u> For diversified warm water biota, including game fish, the daily dissolved oxygen concentration shall be maintained at a minimum of not less than 4.0 mg/L during the low 7-day, once-in-ten-years flow. However, at all greater flows dissolved oxygen shall be maintained at not less than 5.0 mg/L, assuming there are normal seasonal and daily variations above this level; except that under extreme conditions, with the same stipulations as to seasonal and daily variations, the dissolved oxygen level may range between 5.0 mg/L and 4.0 mg/L for short periods of time, provided that the water quality is maintained in favorable conditions in all other respects.

H.1.32. <u>Toxic Substances, Color, Taste, and Odor Producing Substances.</u> There shall be no substances added, whether alone or in combination with other substances, that will impair the use of waters from that which it is classified. The concentration of toxic pollutants shall not exceed one-tenth (1/10th) of the 96-hour median tolerance

* The current applicable dissolved oxygen standard for Mississippi was promulgated by EPA on April 30, 1979 and is presented in subsequent paragraphs for specific designated water use classifications.

The monthly arithemetic average of total coliform MPN (most probable number) shall not exceed 10,000/100 mL nor shall the monthly arithmetic average of fecal coliforms exceed 2,000/100 mL.

o Standard No. 4 - Shellfish Propagation

The median fecal coliform bacteria concentration should not exceed 14 MPN/100 mL with not more than 10 percent of samples exceeding 43 MPN/100 mL for the taking of shellfish.

APPLICABLE MISSISSIPPI STATE STANDARDS

H.1.25. The Mississippi Department of Natural Resources - Bureau of Pollution Control has published water quality standards that are applicable to inland and coastal waters of Mississippi. These standards relate to the condition of the water body as affected by waste discharges or human activity as opposed to purely natural phenomena.

MINIMUM CONDITIONS APPLICABLE TO ALL WATERS

H.1.26. Waters shall be free from substances attributable to muncipal, industrial, agricultural or other discharges that will settle to form putrescent or otherwise objectionable sludge deposits.

H.1.27. Waters shall be free from floating debris, oil, scum, and other floating materials attributable to municipal, industrial, agricultural or other discharges in amount sufficient to be unsightly or deleterious.

H.1.28. Waters shall be free from materials attributable to municipal, industrial, agricultural or other discharges producing color, odor, or other conditions in such degree as to create a nuisance.

DO concentration in surface coastal waters shall be greater than 5 mg/L except when the upwellings and other natural phenomena may cause the concentration to be depressed.

H.1.23. Bacterial Standards. The bacterial standard applicable to a particular stream segment depends on the use classification of that individual stream segment. Limitations are placed on either fecal or total coliform content, or a combination of both, in order to achieve the stream sanitary quality required for the most restrictive stream water usage.

H.1.24. For each individual Louisiana stream segment, one of the following four standards is applicable according to present and anticipated usage of the stream waters:

- Standard No. 1 - Primary Contact Recreation

Based on a minimum of not less than 5 samples taken over not more than a 30-day period, the fecal coliform content shall not exceed a log mean of 200/100 mL nor shall more than 10 percent of the total samples during any 30-day period exceed 400/100 mL.

- Standard No. 2 - Secondary Contact Recreation

Based on a minimum of not less than five samples taken over not more than a 30-day period, the fecal coliform content shall not exceed a log mean of 1,000/100 mL nor shall more than 10 percent of the total samples during any 30-day period equal or exceed 2,000/100 mL.

- Standard No. 3 - Public Water Supply

H.1.21. Chlorides, Sulfates, and Dissolved Solids. Values for these parameters apply to the approximate midpoint of the stream segment with reasonable gradients applying towards segment boundaries. Values listed in the standards in general represent the arithmetic mean of existing data plus one standard deviation. These standards are not applicable to estuarine or coastal waters.

H.1.22. Dissolved Oxygen. The dissolved oxygen (DO) values represent minimum values for the type of water specified. These values shall apply at all times except in naturally-dystrophic waters or where natural conditions cause the DO to be depressed. For short periods of time, diurnal variations below the standard specified may occur. However, no waste discharge or activity of man shall lower the DO concentration to the point where the diurnal variation falls below the specified minimum.

- Fresh Water DO

For a diversified warm water biota including some fish, the daily DO concentration shall be above 5 mg/L assuming normal seasonal and daily variations are above this concentration. However, the concentration may range between 5 and 4 mg/L for short periods of time during a 24-hour period, provided the water quality is favorable in all other respects.

- Estuarine Water DO

DO concentrations in estuaries and tidal tributaries shall not be less than 4 mg/L at any time or place except in naturally-dystrophic waters, or where natural conditions cause DO to be depressed.

- Coastal Water DO

- Freshwater temperature standard
  - Differential

    5°F (2.8°C) rise above ambient for streams and rivers.
    3°F (1.7°C) rise above ambient for lakes and reserviors.
  - Maximum

    90°F (32.2°C) for all freshwater bodies except where listed otherwise on the tables or due to natural conditions.

- Estuarine and coastal waters temperature standards
  - Differential

    4°F (2.2°C) rise above ambient October through May
    1.5°F (0.83°C) June through September

  - Maximum

    95°F (35°C) except when natural conditions elevate temperature above this level.

H.1.19. These temperature standards shall not apply to privately-owned reserviors constructed solely for industrial purposes.

H.1.20. pH. The pH represents minimum and maximum conditions throughout the segment with reasonable gradients applying towards segment boundaries. In all cases, the pH shall fall within the range of 6.0 to 9.0 unless otherwise specified in the tables. No discharge of wastes shall cause the pH of the water body to vary by more than one pH unit within the specified pH range for that segment where the discharge occurs. (This does not apply in the Mixing Zone.)

H.1.14. The following is a description of general criteria and water quality standards applicable to all surface waters in the state of Louisiana.

H.1.15. Color. True color shall not be increased to the extent that it will interfere with present usage and projected future use of the streams and water bodies.

- Waters shall be virtually free from objectionable color.
- source of supply shall not exceed 75 color units on the platinum-cobalt scale for domestic water supplies.
- Increased color (in combination with turbidity) shall not reduce the depth of the compensation point for photosynthetic activity by more than 10 percent from the seasonally-established norm for aquatic life.

H.1.16. Temperature. The temperature standards in Table H-1-1 represent maximum values obtained from existing data, except under conditions of extremely low flows and unusually high air temperatures.

H.1.17. In order to protect a diversified warm water biota including game fish, the following temperature standard shall apply (except when natural conditions cause the temperature to be raised above these limits).

H.1.18. The standard shall consist of two parts, a temperature differential and a maximum temperature. The temperature differential represents the maximum permissable rise above ambient conditions. There shall be no addition of artificial heat once the ambient temperature reaches the maximum temperature specified in the standards.

TABLE H-1-1 (CONTINUED)

LECC NUMERICAL STANDARDS APPLICABLE TO SELECTED SURFACE WATERS IN THE STUDY AREA

SEGMENT DESCRIPTION	WATER USES A	B	C	D	CL mg/L	SO4 mg/L	DO mg/L	PH RANGE SU	BAC STD	TEMP °C	TDS mg/L
LAKE ST. CATHERINE (TIDAL)		X	X		N/A	N/A	4.0	6.5 TO 9.0	4	35	N/A
RIGOLETS AND CHEF MENTEUR PASS (TIDAL)	X	X	X		N/A	N/A	4.0	6.5 TO 9.0	4	35	N/A
INTRACOASTAL WATERWAY - MISSISSIPPI RIVER TO		X	X		N/A	N/A	4.0	6.5 TO 9.0	4	35	N/A
MISSISSIPPI STATE LINE (TIDAL)		X	X		N/A	N/A	4.0	6.5 TO 9.0	4	35	N/A
MISSISSIPPI RIVER-GULF OUTLET - INTRACOASTAL CANAL TO BRETON SOUND (TIDAL)		X	X		N/A	N/A	4.0	6.5 TO 9.0	4	35	N/A
LAKE BORGNE (TIDAL)	X	X	X		N/A	N/A	5.0	6.5 TO 9.0	4	35	N/A
MISSISSIPPI RIVER: FROM HUEY P. LONG BRIDGE TO HEAD OF PASSES		X	X	X	75	120	5.0	6.5 TO 9.0	3	32	400
MISSISSIPPI RIVER: FROM OLD RIVER CONTROL STRUCTURE TO HUEY P. LONG BRIDGE ABOVE NEW ORLEANS		X	X	X	75	120	5.0	6.5 TO 9.0	3	32	400
PEARL RIVER: I-10 TO LAKE BORGNE (INCLUDES WEST PEARL, WEST MIDDLE PEARL, AND MIDDLE PEARL (TIDAL)	X	X	X		N/A	N/A	5.0	6.5 to 9.0	1	35	N/A

Water Uses - A: Primary Contact Recreation; B: Secondary Contact Recreation; C: Propagation of Fish and Wildlife; D: Domestic Raw Water Supply.

TABLE H-1-1
LECC NUMERICAL STANDARDS APPLICABLE TO SELECTED SURFACE WATERS IN THE STUDY AREA

SEGMENT DESCRIPTION	WATER USES A	B	C	D	CL mg/L	SO4 mg/L	DO mg/L	PH RANGE SU	BAC STD	TEMP °C	TDS mg/L
LAKE MAUREPAS	X	X	X		1000	200	5.0	6.0 TO 8.5	1	32	3000
PASS MANCHAC - LAKE MAUREPAS TO LAKE PONTCHARTRAIN	X	X	X		1000	1000	5.0	6.5 TO 9.0	1	32	3000
TANGIPAHOA RIVER - MISSISSIPPI STATE LINE TO LAKE PONTCHARTRAIN (SCENIC RIVER)	X	X	X		11	11	5.0	6.0 TO 8.5	1	30	140
TCHEFUNCTA RIVER - HEADWATERS TO LAKE PONTCHARTRAIN (SCENIC RIVER)	X	X	X		21	9	5.0	6.0 TO 8.5	1	30	106
BAYOU LACOMBE - HEADWATERS TO LAKE PONTCHARTRAIN		X	X		30	30	5.0	6.0 TO 8.5	1	32	150
BAYOU BONFOUCA - SLIDELL TO LAKE PONTCHARTRAIN		X	X		250	100	5.0	6.0 TO 8.5	1	32	500
LAKE PONTCHARTRAIN - WEST OF HIGHWAY 11 BRIDGE (TIDAL)	X	X	X		N/A	N/A	4.0	6.5 TO 9.0	1	35	N/A
LAKE PONTCHARTRAIN - EAST OF HIGHWAY 11 BRIDGE (TIDAL)	X	X	X		N/A	N/A	4.0	6.5 TO 9.0	4	35	N/A
INNER HARBOR NAVIGATIONAL CANAL - MISSISSIPPI RIVER TO LAKE PONTCHARTRAIN (TIDAL)		X	X		N/A	N/A	4.0	6.5 TO 9.0	1	35	N/A

TABLE H-1-3

EPA WATER QUALITY CRITERIA FOR SELECTED CONTAMINANTS

	Ambient Water Concentrations† for the Protection of Saltwater Aquatic Life				Ambient Fresh Water Concentrations† for the Protection of Human Health							
					Non Carcinogens		Carcinogens††					
	24-h Average	Maximum at any Time	Selected Acute Toxicity	Selected Chronic Toxicity	Toxic[A]	Toxic[B]	Incremental Cancer Risk[C] 10^{-5}	10^{-6}	10^{-7}	Incremental Cancer Risk[D] 10^{-5}	10^{-6}	10^{-7}
Non-Carcinogenic Inorganics												
Cadmium	4.5 ug/l	59 ug/l			10 ug/l							
Chromium, hexavalent	18.0 ug/l	1,260 ug/l			50 ug/l							
Copper	4.0 ug/l	23 ug/l										
Cyanide			30 ug/l	2 ug/l	200 ug/l							
Iron				1,000 ug/l*								
Lead			668 ug/l	25 ug/l	50 ug/l							
Manganese				100 ug/l*								
Mercury	0.10 ug/l	3.7 ug/l			0.144 ug/l	0.146 ug/l						
Nickel	7.1 ug/l	140.0 ug/l			13.4 ug/l	100 ug/l						
Zinc	58.0 ug/l	170.0 ug/l										
Carcinogenic Inorganics												
Arsenic, trivalent inorganic			508 ug/l				22 ng/l	2.2 ng/l	0.22 ng/l	175 ng/l	17.5 ng/l	1.75 ng/l
Beryllium							37 ng/l	3.7 ng/l	0.37 ng/l	641 ng/l	64.1 ng/l	6.41 ng/l
Non Carcinogen Pesticide												
Endrin	0.0023 ug/l	0.037 ug/l			1.0 ug/l							
Carcinogenic Pesticides												
Aldrin		1.30 ug/l					0.74 ng/l	0.074 ng/l	0.0074 ng/l	0.79 ng/l	0.079 ng/l	0.0079 ng/l
Chlordane	0.004 ug/l	0.09 ug/l					4.60 ng/l	0.460 ng/l	0.0046 ng/l	4.80 ng/l	0.480 ng/l	0.0480 ng/l
DDT	0.001 ug/l	0.13 ug/l					0.24 ng/l	0.024 ng/l	0.0024 ng/l	0.24 ng/l	0.024 ng/l	0.0024 ng/l
Dieldrin	0.0019 ug/l	0.71 ug/l					0.71 ng/l	0.071 ng/l	0.0071 ng/l	0.76 ng/l	0.076 ng/l	0.0076 ng/l
Non Carcinogenic Volatile and Semi-Volatile Organics												
Dibutyl-phthalate			2,994 ug/l	3.4 ug/l	34 mg/l	15[illegible] mg/l						
Di-2-ethylhexyl-phthalate			2,994 ug/l	3.4 ug/l	15 mg/l	50.0 mg/l						
Dichlorobenzene			1,970 ug/l		400 ug/l	2.6 mg/l						
Carcinogenic Volatile Organics												
1,2-dichloroethane			113,000 ug/l				9.4 ug/l	0.94 ug/l	0.094 ug/l	2,430.0 ug/l	243.0 ug/l	24.3 ug/l
Bromodichloromethane			12,000 ug/l	6,400 ug/l			1.9 ug/l	0.19 ug/l	0.019 ug/l	157.0 ug/l	15.7 ug/l	1.57 ug/l
Chloroform							1.9 ug/l	0.19 ug/l	0.019 ug/l	157.0 ug/l	15.7 ug/l	1.57 ug/l
Hexachlorobenzene			160 ug/l	129 ug/l			7.2 ng/l	0.72 ng/l	0.072 ng/l	7.4 ng/l	0.74 ng/l	0.074 ng/l
Tetrachloroethylene			10,200 ug/l	450 ug/l			8.0 ug/l	0.8 ug/l	0.08 ug/l	88.5 ug/l	8.85 ug/l	0.88 ug/l
Trichloroethylene			2,000 ug/l				27.0 ug/l	2.7 ug/l	0.27 ug/l	807.0 ug/l	80.7 ug/l	8.07 ug/l

† mg/l milligrams per liter (parts per million)
ug/l micrograms per liter (parts per billion)
ng/l nanograms per liter (parts per trillion)

†† The recommended concentrations of carcinogens for maximum protection of human health is zero.

A Ambient water concentration for the protection of human health from toxic properties of contaminants ingested through water and contaminated aquatic organisms.

B Ambient water concentration for the protection of human health from toxic properties of contaminants ingested through contaminated aquatic organisms alone.

C Ambient water concentrations which may result in incremental increase of cancer risks at 10^{-5} to 10^{-7} (one additional case of cancer in populations ranging from 100,000 to ten million, respectively). These criteria are based upon a [illegible] for the exposed individual, the average daily consumption of freshwater and estuarine fish and shellfish products equal to 6.5 grams per day; and, the average ingestion of two liters of water per day.

D Ambient water concentrations which may result in incremental increase of cancer risks of 10^{-5} to 10^{-7} through ingestion of contaminated aquatic organisms alone, excluding consumption of water.

* [illegible] quality criteria for water. All other criteria are from Notice of Water Quality Criteria Documents, Availability. Federal Register, Friday 28 November 1980, pp. 79317-79379.

TABLE H-1-4

EPA FRESHWATER AQUATIC LIFE CRITERIA

(All values in ug/L)

	24-hour	Maximum
Mercury*	0.20	4.1
Lead*	0.75/3.8	74/170
Zinc*	47	180/320
Chromium, Hexavalent	0.29	21
Chromium Trivalent*	44	2200/4700
Cadmium*	0.012/0.025	1.5/3.0
Copper*	5.6	12/22
Nickel*	56/96	1100/1800
Arsenic	-	440
Aldrin	-	3.0
Chlordane	0.004	2.4
DDD	0.001	1.1
DDE	0.001	1.1
DDT	0.001	1.1
Dieldrin	0.002	2.5
Endrin	0.002	0.18
Heptachlor	0.004	0.52
Lindane	0.08	2.0
PCB	0.014	-
Toxaphene	0.013	1.6
Mirex	-	
Methoxychlor		

* Criteria dependent on hardness. Values are shown for hardness. Values are shown for hardness concentrations of 50/100 mg/l as $CaCo_3$, respectively.

Section 2. SOURCE OF WATER QUALITY DATA AND METHOD OF ANALYSIS

H.2.1. No water quality samples were specifically collected and analyzed to provide data for this study. Water quality data used in the investigation were obtained from the Water Quality File of the computerized STORET System data base. Consequently, it is assumed in this evaluation that the samples collected by the various agencies are representative and that the retrieved data are adequate in terms of care in sampling, analytical competence, and accurate storage into the data base. Where obvious errors in stored data were noted, these data were omitted from the analysis. For the general water quality characterization and analysis, data from several sampling stations in an area of investigation were, in some cases, aggregated. Thus, in some instances, data presented for an area of investigation represent both the spatial and temporal variations in water quality. There are several inconsistencies that could lead to inaccurate conclusions inherent in this approach.

- Not all water quality parameters of interest were measured at each sampling station in a data aggregate.

- Typically, stations within a data aggregate have different periods of record.

- Various chemical analysis techniques with divergent detection limits were used to determine constituent concentrations.

- Sampling stations were not uniformly distributed over each area investigated.

H.2.2. However, the aggregation of data from many locations within an area produced large but manageable sets of observations. Given the inherent variability in water quality data, it was felt that this approach would be most expedient for characterizing the general quality of the extensive water bodies in the study area.

Section 3. MISSISSIPPI RIVER: INITIAL WATER QUALITY INVESTIGATIONS

H.3.1. In reconnaissance investigations, data from 10 recently active water quality sampling stations were extracted for analysis. The stations are located within the reach of the Mississippi River bounded by river miles 208 and 76 Above Head of Passes (AHP). Six of the stations are sampled by the US Geological Survey (USGS). The remaining four stations are sampled by the Louisiana Department of Natural Resources-Water Pollution Control Division (LDNR-WPCD). The stations are not uniformly distributed along the approximately 132-mile reach but are clustered in six general areas located at or about river miles 208,168,148,120,104, and 80. One station is located at mile 208 (USGS), one at mile 168 (USGS), two at mile 148 (LDNR-WPCD), three near mile 120 (one USGS and two LDNR-WPCD), one at mile 104 (USGS), and two near mile 80 (USGS).

H.3.2. Water quality data from these sampling stations were used in an attempt to determine if significant differences in water quality occur among the segments defined by the sampling station clusters. Segment 1 was defined as river mile 208 to 168 (Plaquemine to Union, Louisiana); segment 2, river mile 168 to 148 (Union to Lutcher, Louisiana); segment 3, river mile 148 to 120 (Lutcher to Luling, Louisiana); segment 4, river mile 120 to 104 (Luling to New Orleans, Louisiana); and segment 5, river mile 104 to 80 (New Orleans to Belle Chasse, Louisiana).

H.3.3. Data for six constituents were extracted for analysis: cadmium, copper, lead, mercury, zinc, and fecal coliform bacteria. The mean concentration of a selected constituent was taken as the arithmetic average of the aggregate data from the stations at the segment boundaries. Data analyses were performed using the Statistical Analysis System (SAS 79.5, 1980) General Linear Models Procedure with Duncan's multiple range test (a=0.05) to indicate significant differences between segment means. The results of the multiple range tests and plots of the reach and segment means are presented as plates H-1 through H-6. Results of this analysis indicate that:

o There is no statistically significant difference in mean cadmium and mercury concentrations measured at the sampling locations between river miles 208 and 80 AHP.

o The mean copper concentrations in segments 3 and 4 (river mile 148 to 120 and river mile 120 to 104, respectively) are significantly higher than the mean concentrations in segments 1, 2, and 5.

o The mean zinc concentration in segment 5 (New Orleans harbor area) is significantly higher than the mean concentrations in segments 3 and 4, but it is not significantly different from the mean concentrations of segments 1 and 2.

o The mean lead concentration in segment 5 is significantly higher than the mean concentrations in segments 1 and 2, but it is not significantly different from the mean concentrations of segments 3 and 4.

o The mean fecal coliform bacterial density in segment 5 is significantly higher than the mean densities of all the other segments.

H.3.4. The mean concentrations of cadmium and mercury, are not statistically different in any of the river segments evaluated. There are some moderate differences in the mean concentrations of specific parameters (particularly fecal coliforms) from segment to segment and there is perhaps some degradation in quality with progression downstream. However, no striking overall differences in water quality are evident from the analysis.

H.3.5. Given this data analysis and the high density industrial development adjacent to the river, it seems equiprobable that a high concentration of any conservative constituent might be detected at any

location in the study reach. Consequently, for the detailed water quality characterization, the mean of the aggregate period of record data available for each particular parameter of interest was taken as typical for the river. Additionally, in some cases, monthly means are also presented to indicate any seasonality apparent in the data.

Section 4. GENERAL WATER QUALITY - EXISTING CONDITIONS

H.4.1. The general character of a water body can be gaged by the examination of various chemical and physical parameters including those indicating available oxygen concentration and oxygen demands, hydrogen ion concentration, temperature, dissolved and suspended solids content, and the concentrations of major inorganic ions and nutrients. Dissolved oxygen (DO) historically has been the single major constituent of interest in water quality investigations. It has been generally considered significant for protecting esthetic qualities of water as well as for maintaining fish and other aquatic life. DO concentrations are an important gage of existing water quality and the ability of a water body to support a well-balanced aquatic fauna. Surface waters considered in the evaluation are indicated on figure H-4-1.

MISSISSIPPI RIVER

H.4.2. Summary statistics that are descriptive of the general quality of the Mississippi River are shown in table H-4-1. On this table, descriptive statistics are provided for data accumulated from water sampling at nine locations within the reach, river mile 168 to river mile 76 AHP. Additionally, summary statistics for the entire reach are shown. The agencies conducting the sampling and the approximate locations where the sampling is conducted are shown in the footnotes to the table and on figure H-4-1.

H.4.3. As is indicated in the table, DO concentrations in the river are normally well above values cited as being desirable for maintenance of well-balanced fish populations. Measured DO in the reach, mile 168 to mile 76 AHP, averaged 8.3 mg/L and about 85 percent of saturation for the period October 1969 to April 1983. During this period, concentrations below the state DO standard of 5.0 mg/L were noted in

TABLE H-4-1

MEASURES OF GENERAL WATER QUALITY-MISSISSIPPI RIVER

	Sampling Station Number*									Nine Station Aggregate
	1	2	3	4	5	6	7	8	9	
Water Temperature, °C										
Number of Observations	177	60	60	57	57	199	172	177	54	1,013
Mean	17.8	17.1	17.1	18.6	18.2	18.0	18.5	18.3	18.2	18.1
Range	1.5-30.0	3.0-31.0	3.0-31.0	5.0-32.8	1.5-32.5	1.5-32.0	1.5-31.0	2.0-32.0	1.5-31.0	1.5-32.8
Period of Record	1/73-1/83	3/78-4/83	3/78-4/83	3/78-4/83	3/78-4/83	2/68-1/83	5/67-1/83	1/73-9/78	10/77-12/82	5/67-4/83
Dissolved Oxygen, mg/L										
Number of Observations	177	61	61	56	56	175	135	176	54	951
Mean	8.6	8.3	8.3	8.0	8.0	8.4	8.2	8.3	8.5	8.3
Range	5.6-13.7	5.5-12.4	3.8-12.5	2.4-12.4	1.6-12.6	5.0-13.4	5.4-	5.2-12.8	5.4-13.2	1.6-13.4
Period of Record	1/73-1/83	3/78-4/83	3/78-4/83	3/78-4/83	3/78-4/83	1/73-1/83	10/69-1/83	1/73-9/78	10/77-12/82	10/69-4/83
Dissolved Oxygen Saturation, %										
Number of Observations	175	60	60	55	54	174	132	174	53	937
Mean	86.7	82.9	82.6	82.7	82.0	85.2	83.5	84.8	85.8	84.6
Range	66.7-	64.7-110.0	64.7-100.0	19.2-105.0	12.8-106	63.3-	64.0-	65.8-	70.2-	12.8-110.0
Period of Record	1/73-1/83	3/78-4/83	3/78-4/83	3/78-4/83	3/78-4/83	1/73-1/83	10/69-1/83	1/73-9/78	10/77-12/82	10/69-4/83
5-Day Biochemical Oxygen Demand, mg/L										
Number of Observations	162	-	-	-	-	158	87	160	53	620
Mean	2.2	-	-	-	-	2.3	2.0	2.3	2.1	2.2
Range	0.0-7.9	-	-	-	-	0.0-8.6	0.0-5.7	0.0-8.9	0.0-6.0	0.0-8.9
Period of Record	1/73-1/83	-	-	-	-	1/73-1/83	12/72-1/83	1/73-9/78	10/77-12/82	12/72-1/83
Total Organic Carbon, mg/L-C										
Number of Observations	116	47	43	41	41	114	25	93	32	552
Mean	7.2	4.6	5.0	4.2	4.3	7.2	6.6	7.2	7.2	6.3
Range	0.9-19.0	1.5-12.0	1.0-18.0	1.5-10.0	0.5-14.0	0.0-18.0	1.0-19.0	1.3-16.0	3.5-14.0	0.0-19.0
Period of Record	1/73-3/83	10/78-4/83	10/78-4/83	10/78-4/83	10/78-4/83	1/73-4/83	12/72-10/82	1/73-9/78	6/77-12/82	12/72-4/83
Chemical Oxygen Demand (High Level), mg/L										
Number of Observations	85	52	38	38	36	83	-	39	-	371
Mean	27	35	39	34	30	28	-	18	-	30
Range	0-73	1-154	4-239	0-84	0-95	3-110	-	5-65	-	0-239
Period of Record	1/76-3/83	3/78-4/83	4/78-4/83	4/78-4/83	4/78-4/83	1/73-3/83	-	1/76-9/78	-	1/73-4/83
pH, field, standard units										
Number of Observations	172	61	61	58	58	501	223	167	56	1,357
Mean	7.5	7.5	7.5	7.6	7.6	7.5	7.6	7.6	7.3	7.5
Range	6.6-8.3	7.2-8.8	7.0-8.3	6.8-8.3	6.5-8.5	6.4-8.2	6.6-8.2	6.7-8.3	6.0-7.9	6.0-8.8
Period of Record	1/73-1/83	3/78-4/83	3/78-4/83	3/78-4/83	3/78-4/83	10/57-1/83	8/54-1/83	1/73-9/78	10/77-12/82	8/54-4/83

TABLE H-4-1 Continued

MEASURES OF GENERAL WATER QUALITY-MISSISSIPPI RIVER

	Sampling Station Number*									
	1	2	3	4	5	6	7	8	9	Nine Station Aggregate
Total Alkalinity, mg/L-$CaCO_3$										
Number of Observations	181	55	34	38	38	510	220	181	57	1314
Mean	104	105	107	106	127	103	103	102	100	104
Range	66-584	15-147	78-150	63-151	10-987	55-152	49-141	66-149	57-142	10-987
Period of Record	1/73-1/83	3/78-4/83	3/78-4/83	3/78-4/83	3/78-4/83	10/57-1/83	8/54-1/83	1/73-9/78	10/77-12/82	8/54-4/83
Total Dissolved Solids, mg/L										
Number of Observations	68	55	42	41	41	536	212	117	195	1307
Mean	226	265	278	272	286	242	228	231	249	243
Range	147-489	114-362	70-536	26-530	170-406	151-344	139-315	140-428	153-399	26-536
Period of Record	1/73-5/76	3/78-4/83	3/78-4/83	3/78-4/83	3/78-4/83	10/57-9/82	8/54-1/83	1/73-4/76	10/77-12/82	8/54-4/83
Total Chloride, mg/L										
Number of Observations	178	59	49	46	46	507	220	180	57	1342
Mean	22	27	32	43	47	25	25	24	28	27
Range	11-63	13-48	13-299	14-551	14-602	10-67	11-64	11-63	14-74	10-602
Period of Record	1/73-1/83	3/78-4/83	3/78-4/83	3/78-4/83	3/78-4/83	10/57-1/83	8/54-1/83	1/73-9/78	10/77-12/82	10/57-4/83
Total Sulfate, mg/L										
Number of Observations	174	56	28	31	30	507	220	180	56	1276
Mean	48	45	43	43	43	53	54	49	55	51
Range	28-85	4-94	13-71	2-78	3-76	28-100	30-88	30-89	33-89	2-100
Period of Record	1/73-1/83	3/78-4/83	3/78-4/83	3/78-4/83	3/78-4/83	10/57-1/83	8/54-1/83	1/73-9/78	10/77-12/82	8/54-4/83
Total Non-filterable Residue, mg/L										
Number of Observations	178	56	42	41	41	198	25	180	-	761
Mean	165	142	137	145	166	151	146	157	-	155
Range	6-2,090	0-380	0-412	0-436	8-500	1-612	2-555	0-609	-	0-2,090
Period of Record	1/73-1/83	3/78-4/83	3/78-4/83	3/78-4/83	3/78-4/83	7/66-1/83	10/74-4/79	1/73-9/78	-	7/66-4/83
Turbidity, JTU										
Number of Observations	72	58	56	53	53	72	64	69	36	533
Mean	58	64	55	57	61	56	58	52	61	58
Range	6-160	4-350	7-125	7-150	5-160	2-230	1-230	1-170	10-240	1-350
Period of Record	10/74-9/80	3/78-4/83	3/78-4/83	3/78-4/83	3/78-4/83	10/74-9/80	10/74-7/80	10/74-9/78	10/77-9/80	10/74-4/83
True Color, PT-CO units										
Number of Observations	177	60	59	56	56	494	206	174	56	533
Mean	19	27	19	19	23	16	13	19	15	18
Range	0-90	10-400	5-100	5-60	5-100	0-100	0-60	0-90	0-80	0-400
Period of Record	1/73-1/83	3/78-4/83	3/78-4/83	3/78-4/83	3/78-4/83	10/57-1/83	8/54-1/83	1/73-9/78	10/77-12/82	8/54-4/83

TABLE H-4-1 Continued

MEASURES OF GENERAL WATER QUALITY-MISSISSIPPI RIVER

	Sampling Station Number*									
	1	2	3	4	5	6	7	8	9	Nine Station Aggregate
Nitrite plus Nitrate, ug/L-N										
Number of Observations	100	60	60	57	56	100	84	69	47	633
Mean	1,350	1,360	1,370	1,300	1,350	1,390	1,210	1,190	1,430	1,320
Range	200-3,100	240-2,480	620-2,400	150-2,400	600-2,340	230-5,100	300-2,500	270-2,300	630-2,600	150-5,100
Period of Record	10/74-1/83	3/78-4/83	3/78-4/83	3/78-4/83	3/78-4/83	10/74-1/83	10/73-1/83	10/74-9/78	10/77-9/81	10/73-4/83
Total Phosphorus ug/L-P										
Number of Observations	113	58	57	55	54	112	85	88	55	677
Mean	222	291	245	289	329	265	260	263	264	264
Range	30-910	90-900	100-520	100-760	110-640	60-620	10-860	130-990	70-510	10-990
Period of Record	10/73-1/83	3/78-4/83	3/78-4/83	3/78-4/83	3/78-4/83	10/73-1/83	10/73-1/83	10/73-9/78	10/77-1/83	10/73-4/83

* Sampling Stations -

1: Mississippi River at Union, Louisiana (112WRD 07374220) 1/73 to 3/83. Located approximately at river mile 168 Above head of Passes (AHP).

2: Mississippi River - East Bank at Lutcher, Louisiana (21LA1ORS B07034-5050) 1/78 to 5/83. Located approximately at river mile 148 AHP.

3: Mississippi River - West Bank at Lutcher, Louisiana (21LA1ORS S070345060) 1/78 to 5/83. Located approximately at river mile 148 AHP.

4: Mississippi River - East Bank at Luling, Louisiana (21LA1ORS S070345070) 1/73 to 5/83. Located approximately at river mile 120 AHP.

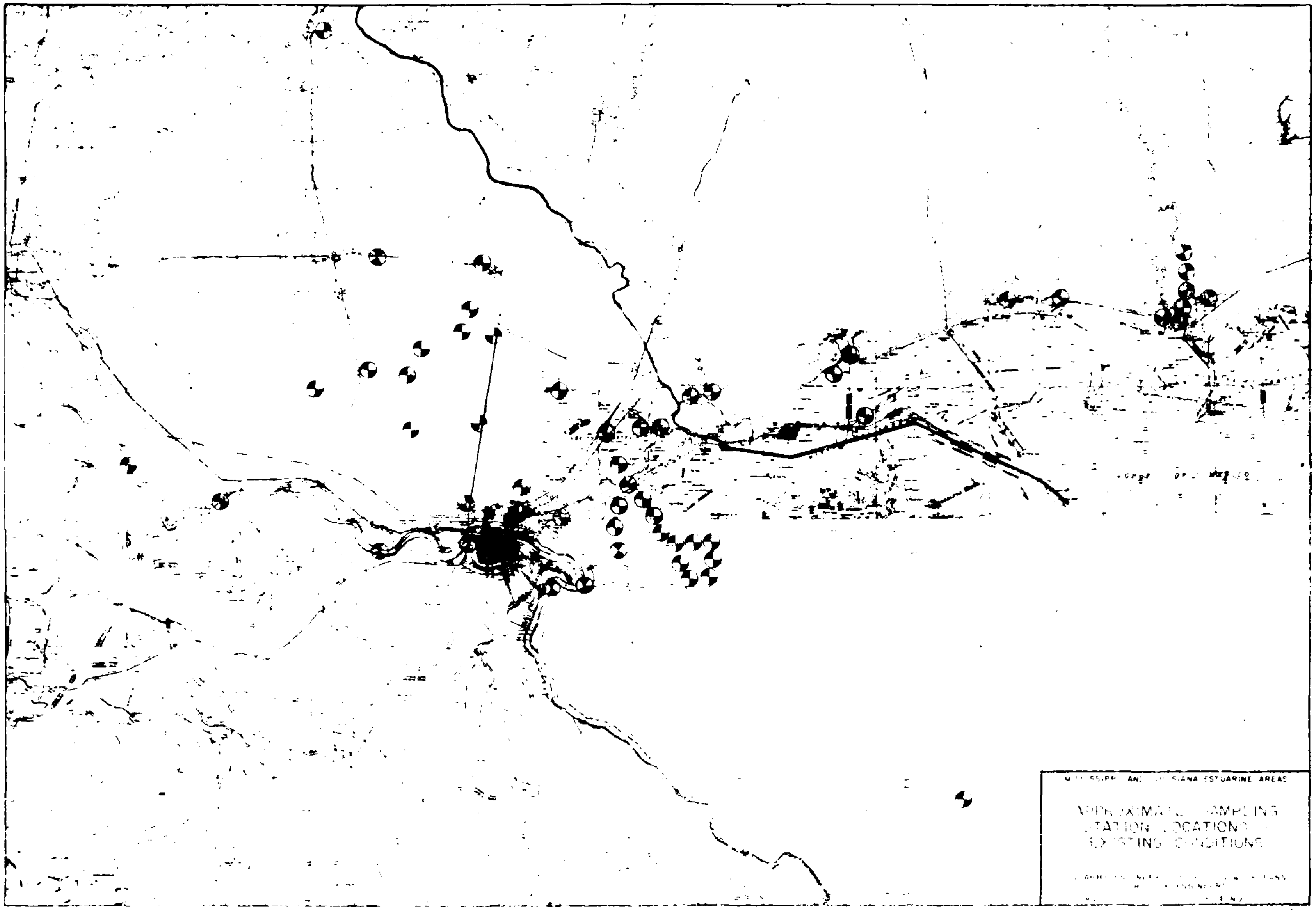
5: Mississippi River - West Bank at Luling, Louisiana (21LA1ORS S070345080) 1/78 to 5/83. Located approximately at river mile 120 AHP.

6: Mississippi River at Luling Ferry, Louisiana (112WRD 07374400) 10/57-3/83. Located approximately at river mile 120 AHP.

7: Mississippi River at New Orleans, Louisiana (112WRD 07374508) 2/53-1/83. Located approximately at river mile 104 AHP.

8: Mississippi River at Violet, Louisiana (112WRD 07374522) 1/73-9/78. Location was approximately at river mile 83 AHP.

9: Mississippi River at Belle Chasse, Louisiana (112WRD 07374525) 8/76-1/83. Located approximately at river mile 76 AHP.


MISSISSIPPI AND LOUISIANA ESTUARINE AREAS
APPROXIMATE SAMPLING
STATION LOCATIONS
EXISTING CONDITIONS

only 5 of 951 observations. The 5-day biochemical oxygen demand (BOD_5) of substances in the river averaged 2.2 mg/L during the October 1969 to April 1983 period. Data such as these indicate the river's capacity to assimilate by dilution, reaeration, or photosynthetic action the large quantities of oxygen-demanding wastes discharged upstream of New Orleans. As indicated in table H-1-1, the State of Louisiana has published numerical standards for temperature and in-stream concentrations of chloride (CL), sulfate (SO_4), hydrogen ion (pH), and total dissolved solids (TDS). Concentrations in excess of state standards for these parameters have also occurred infrequently in the reach of the river investigated. For the respective periods indicated on table H-4-1, less than one percent of the total observations made for these parameters were in excess of the state standards. Long-term annual averages for temperature, CL, SO_4, pH, and TDS are about 18.1°C, 28 mg/L, 55 mg/L, 7.5 standard units, and 249 mg/L respectively. Distributions of surface water temperatures (March 1961 to September 1981) measured for the Mississippi River at New Orleans are shown on table H-4-2.

H.4.4. The river is normally characterized by highly turbid waters due to the enormous suspended sediment load transported. Data from the USGS indicated that, on the average, approximately 77 percent of the river's suspended sediment discharge is transported as silt and clay (particles smaller than 0.062 millimeter in diameter). Maximum concentrations generally occur in late winter or early spring and have an average composition of about 82 percent silt and clay, and about 18 percent sand in the upper 20 percent of the water column. The suspended residue concentration in the reach investigated averaged about 155 mg/L during the period January 1973 through April 1983.

H.4.5. The river is further characterized by the data in tables H-4-3 and H-4-4. These tables summarize detected concentrations of several

TABLE H-4-2

SURFACE WATER TEMPERATURE[1/] - MISSISSIPPI RIVER AT NEW ORLEANS[2/]

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Number of Observations	360	320	407	408	396	388	388	391	369	410	367	367
Mean (logarithmic)	6.1	6.6	9.7	14.5	20.2	24.9	27.9	28.6	27.3	22.3	16.0	10.0
Range	3.3-10.6	2.5-11.1	4.4-15.0	8.3-20.5	10.0-27.0	19.0-29.4	23.5-31.7	24.0-31.0	22.2-31.0	17.0-27.0	8.0-26.0	4.9-16.0
Weighted Percentiles[3/]												
5	3.8	4.4	7.2	10.5	17.7	21.0	25.0	26.0	24.7	18.3	12.0	6.1
10	4.3	4.4	7.2	11.6	18.0	22.2	26.0	26.6	25.5	19.4	12.8	7.5
20	4.9	5.5	7.7	12.7	18.8	23.3	26.6	27.2	26.0	20.0	13.9	8.3
30	5.5	6.1	8.3	13.3	19.4	24.4	27.1	28.3	26.6	21.0	15.0	8.9
40	6.0	6.1	9.4	13.9	20.0	24.9	27.7	28.8	27.0	21.6	15.5	9.9
50 (median)	6.1	6.7	9.9	14.9	20.3	25.5	28.3	28.9	27.2	22.7	16.0	10.0
60	6.7	7.2	10.1	15.5	20.6	26.0	28.8	29.4	27.7	23.3	17.2	11.1
80	7.8	8.0	12.2	17.2	21.7	26.6	29.4	29.6	28.8	24.9	18.3	12.2
90	8.8	8.3	13.3	18.3	22.8	27.2	29.5	30.0	29.4	26.0	19.4	13.3
95	9.4	9.4	13.9	18.8	23.9	27.8	30.0	30.5	29.4	26.0	20.6	14.4

1/ All values are degrees Celsius
2/ Mississippi River at New Orleans, Louisiana (11COELMN 01300) 3/63 to 9/81
3/ Distributions of daily surface water temperatures. Percentiles are members of the set of observations such that 11 x 4 percent of the observations are less than or equal to the percentile value shown.

TABLE B-4-3
MACRONUTRIENT CONCENTRATIONS IN THE MISSISSIPPI RIVER

	Number of Samples	Range of Concentrations Mean	Maximum	Minimum
bon dioxide mg/L	929	6.9	63.0	0
arbonate ion mg/l	953	124	182	67
cium, dissolved mg/L	876	40.0	59	26
nesium, dissolved mg/L	877	11.1	21	3.2
ium, dissolved mg/L	1,555	24	690	0
ium Adsorption Ratio	644	0.8	2.7	0.4
cent Sodium, percent	641	23	49	1
assium, dissolved mg/L	677	3	8.1	1
ionized + Ionized Ammonia, issolved as N ug/l	27	177	2,200	0
ionized + Ionized Ammonia, otal as N ug/L	504	332	1,260	0
ionized Ammonia, NH_3 ug/L	410	12	81	0
rite + Nitrate as N, total ug/L	409	1,183	5,100	10
al Phosphate as P ug/L	216	179	489	5
uble Phosphate as P ug/L	417	66	196	0
sphorus, total as P ug/L	327	317	1,400	0
sphorus, dissolved as P ug/L	190	75	320	0

Period of record, mean, maximum and minimum values

H.4.24. Observations of total nonfilterable residue (suspended solids), turbidity, and true color made for the upstream sampling station average about 20 mg/L, 15 JTU, and 20 PT-CO units, respectively. Generally, larger sample means were computed from total nonfilterable residue and turbidity data for the downstream sampling station. The mean of the total nonfilterable residue data, 34 mg/L, is about 70% greater and the turbidity data sample means, 27 JTU, is about 80% greater. However, the true color data sample mean, 21 PT-CO units, is generally comparable to that computed for the upstream sampling station.

H.4.25. Mean macronutrient concentrations appear comparable for the two sampling locations. Observed nitrite plus nitrate concentrations average about 287 ug/L-N for the upstream sampling station and about 280 ug/L-N for the downstream sampling location. Observed total ammonia (NH_3 + NH_4) concentrations average about 89 ug/L-N and computed un-ionized ammonia (NH_3) concentrations average about 0.1 ug/L-N for the downstream sampling location. No ammonia data were available for the upstream sampling location. Total ammonia concentrations as high as 220 ug/L have been recorded; however, the generally acidic conditions preclude the formation of large concentrations of highly toxic un-ionized ammonia. Sample means for total phosphorus concentrations are 104 ug/L-P and 123 ug/L-P for the upstream and downstream sampling locations, respectively.

TCHEFUNCTA RIVER

H.4.26. Data for the general water quality characterization of the Tchefuncta River are presented in table H-4-7. Descriptive statistics are shown for two selected sampling locations. One sampling location is at the US 190 bridge, west-northwest of Covington, Louisiana. As is indicated in the footnote to the table, the summary statistics listed for the Tchefuncta River at this location are the result of an

H.4.22. Sample means of pH measurements are 6.6 standard units (su) for the upstream sampling station and 6.2 su for the downstream sampling location. Only one of the 61 pH observations made at the upstream sampling station was below the 6.0 su state standard. About 26 percent of the pH data record for the downstream sampling location indicate pH measurements below the state standard. However, a trend plot of these data indicates that the frequency of measured low pH values is decreasing for this location. Since 1978, pH data accumulated show about eight percent of the observations below the state standard. The total alkalinity data suggest that waters of the Tangipahoa River, like those of Lake Maurepas, are not well buffered. Total alkalinity measurements average about 14 mg/L-$CaCO_3$ for each sampling location. Recorded total alkalinity observations range from 6 to 30 mg/L-$CaCO_3$ for the upstream sampling station and zero to 50 mg/L-$CaCO_3$ for the downstream location. About 93 percent of the alkalinity data for the upstream station and about 91 percent of the data for the downstream location were below 20 mg/L. The apparent naturally low buffer capacity of the river waters is most probably a contributing factor in the preponderance of recorded low pH values.

H.4.23. Measurements of total dissolved solids (TDS), total chloride (CL), and total sulfate (SO_4) concentrations average about 61 mg/L, 14 mg/L, and 4 mg/L, respectively, for the upstream sampling location. About two percent of the TDS data, about 51% of the chloride data, and about three percent of the sulfate data for this location exceed applicable state standards. Sample means of TDS, CL, and SO_4 data for the downstream sampling location are comparable at about 65 mg/L, 9 mg/L, and 3 mg/L, respectively. Approximately 7% of the TDS data exceed the 140 mg/L state standard, about 13% of the CL data exceed the 11 mg/L state standard, and about 3% of the SO_4 data exceed the 11 mg/L state standard.

H.4.19. Averages of water temperature data are 18.9 °C and 19.7°C for the upstream (Highway 38 bridge) and downstream (Highway 190 bridge) locations, respectively. Individual water temperature observations have ranged from 6 °C to 29 °C at the upstream sampling station and 3 °C to 31 °C at the downstream location. Only two of the 381 water temperature measurements made at the downstream sampling location were greater than the 30 °C state standard for the Tangipahoa River.

H.4.20. All of the recorded dissolved oxygen values for both sampling locations were greater than the 5.0 mg/L state standard. Sample means for dissolved oxygen concentrations are 8.7 mg/L for the upstream station and 8.4 mg/L for the downstream location. The mean values of measured dissolved oxygen as a percentage of saturation are comparable for the two locations, about 90.9 percent (upstream) and 89.4 percent (downstream). About eight percent of the record of percentage of saturation values for the upstream location imply dissolved oxygen concentrations below 80% of saturation. At the downstream location, about one percent of the data indicate dissolved oxygen concentrations greater than 120% of saturation and about 9% suggest dissolved oxygen concentrations less than 80% saturation.

H.4.21. Five-day biochemical oxygen demand (BOD_5) data are only availabale for the selected downstream sampling location. Measured BOD_5 concentrations ranged from 0.0 to 9.0 mg/L and average 1.6 mg/L for the period November 1969 to January 1983. Chemical oxygen demand (COD) data range from zero to 74 mg/L and average 18 mg/L for the upstream sampling station. COD data for the downstream sampling location average about 22 mg/L and range from zero to 84 mg/L. Sample means of the total organic carbon measurements are 2.6 mg/L-C and 3.1 mg/L for the upstream and downstream locations, respectively.

TABLE H-4-6 (CONTINUED)

MEAUSRES OF GENERAL WATER QUALITY-TANGIPAHOA RIVER

	Tangipahoa River at Highway 38 Bridge 1/	Tangipahoa River at U. S. Highway 190 Bridge 2/
Total Chloride, mg/L		
Number of Observations	59	385
Mean	14	9
Range	5-83	0-100
Period of Record	3/78-4/83	4/44-4/83
Total Sulfate, mg/L		
Number of Observations	50	295
Mean	4	3
Range	0-23	0-58
Period of Record	3/78-4/83	4/44-4/83
Total Non Filterable Residue, mg/L		
Number of Observations	56	193
Mean	20	34
Range	0-284	0-634
Period of Record	3/78-4/83	5/66-4/83
Turbidity, JTU		
Number of Observations	58	317
Mean	15	27
Range	3-115	2-250
Period of Record	3/78-4/83	12/58-4/83
Color, PT-CO units		
Number of Observations	60	379
Mean	20	21
Range	5-70	0-100
Period of Record	3/78-4/83	8/54-4/83
Nitrite plus Nitrate, ug/L-N		
Number of Observations	60	93
Mean	287	280
Range	26-540	20-660
Period of Record	3/78-4/83	1/75-4/83
Total Phosphorus, ug/L-P		
Number of Observations	59	99
Mean	104	123
Range	30-700	20-600
Period of Record	3/78-4/83	7/74-4/83

1/ Tangipahoa River at Highway 38 Bridge (21LA1ORS B042180010) 3/78-4/83

2/ Tangipahoa River at U. S. Highway 190 Bridge (21LA1ORS 9001, 12/58-2/78; 21LA1ORS B042180030, 3/78-4/83; 112WRD 07375500, 10/43-1/83)

TABLE II-4-6

MEASURES OF GENERAL WATER QUALITY TANGIPAHOA RIVER

	Tangipahoa River at Highway 38 Bridge[1/]	Tangipahoa River at U. S. Highway 190 Bridge [2/]
Water Temperature, °C		
Number of Observations	61	381
Mean	18.9	19.7
Range	6.0-29.0	3.0-31.0
Period of Record	3/78-4/83	10/43-4/83
Dissolved Oxygen, mg/L		
Number of observations	61	305
Mean	8.7	8.4
Range	6.3-11.0	5.6-14.8
Period of Record	3/78-4/83	1/63-4/83
Dissolved Oxygen Saturation, %		
Number of Observations	61	304
Mean	90.9	89.4
Range	65.7-101.0	52.0-137.0
Period of Record	3/78-4/83	1/63-4/83
5-Day Biochemical Oxygen Demand, mg/L		
Number of Observations	-	65
Mean	-	1.6
Range	-	0.0-9.0
Period of Record	-	11/69-1/83
Total Organic Carbon, mg/L-C		
Number of Observations	47	64
Mean	2.6	3.1
Range	0.0-7.0	0.0-13.0
Period of Record	10/78-4/83	7/75-4/83
Chemical Oxygen Demand (High Level), mg/L		
Number of observations	51	62
Mean	18	22
Range	0-74	0-84
Period of Record	3/78-4/83	11/69-4/83
pH, field, standard units		
Number of Observations	61	387
Mean	6.6	6.2
Range	5.8-8.0	4.2-7.7
Period of Record	3/78-4/83	4/44-4/83
Total Alkalinity, mg/L as $CaCO_3$		
Number of Observations	55	383
Mean	14	14
Range	6-30	0-50
Period of Record	3/78-4/83	10/43-4/83
Total Dissolved Solids, mg/L		
Number of Observations	54	286
Mean	61	65
Range	10-154	0-778
Period of Record	3/78-4/83	4/44-4/83

H.4.16. Both the mean concentrations for the nitrite plus nitrate and total phosphorus data are significantly higher for the Lake Maurepas sampling location compared to the Pass Manchac location. The average of the nitrite plus nitrate data for Lake Maurepas is about 219 ug/L-N - about 67% greater than the 131 ug/L-N mean for Pass Manchac. The mean of the total phosphorus data for Lake Maurepas is about 142 ug/L-P-- about 53% greater than the 93 ug/L-P mean of the Pass Manchac data. Generally, these data suggest that Lake Maurepas functions as a nutrient sink, removing much of the nutrient load of its upstream tributaries from the water column.

TANGIPAHOA RIVER

H.4.17. Data descriptive of the general quality of the Tangipahoa River are shown in table H-4-6. Descriptive statistics are presented for two selected sampling locations. One sampling station is located well upstream of Lake Pontchartrain in the northern portion of the basin at the Highway 38 bridge. Sampling at this location is conducted monthly by the Louisiana Department of Natural Resources-Water Pollution Control Division (LDNR-WPCD). The other selected sampling location is at US Highway 190 west of Robert, Louisiana. As is indicated in the footnote to the table, the summary statistics listed for the Tangipahoa River at US Highway 190 are the result of an aggregation of data. Water quality monitoring has been conducted at this location by both the US Geological Survey-Water Resources Division and the LDNR-WPCD.

H.4.18. Generally, the sample means for the various water quality parameters are similar for the two distant sampling locations. The ranges of measured values are generally greater for the Highway 190 sampling location. This is perhaps due to the larger sample size which resulted from aggregating data generated by the two agencies which have sampled this location.

H.4.14. The sample means of total dissolved solids, total chloride, total sulfate, and the mean of salinity computations are most clearly reflective of the influence of inflows from Lake Pontchartrain on values measured at the Lake Maurepas and Pass Manchac sampling locations. Total dissolved solids data for the Pass Manchac sampling station range from 30 mg/L to 6,846 mg/L and average about 1,631 mg/L. About 13% of these data were above the 3,000 mg/L state standard for total dissolved solids. The means of the total choloride, total sulfate, and salinity data for the Pass Manchac sampling station are 853 mg/L, 106 mg/L, and 1.6 ppt, respectively. By comparison, chloride, sulfate, and salinity data average 160 mg/L, 28 mg/L, and 0.3 ppt, respectively, for the Lake Maurepas sampling location. Review of the chloride data for Pass Manchac indicates that about 33% of the samples collected had chloride concentrations higher than the 1,000 mg/L state standard. Only one percent of the chloride data record for the Lake Maurepas sampling location was in excess of the applicable 1,000 mg/L standard.

H.4.15. The means of total nonfilterable residue (suspended solids) and true color measurements for the two sampling locations are significantly different in magnitude. The mean of the total nonfilterable residue data for Lake Maurepas is about 19 mg/L; the average of the Pass Manchac data is about 37% greater at about 26 mg/L. True color, which generally results from dissolved or colloidal vegetable extracts, is distinguished from apparent color which may result from the presence of both vegetable extracts and suspended solids. The mean of the true color data for Pass Manchac is about 36 PT-CO (platinum-cobolt) units; the average of the Lake Maurepas is about 44% greater at about 52 PT-CO units. The sample means for turbidity measurements for the two sampling locations are comparable--about 21 JTU for Lake Maurepas and about 20 JTU for Pass Manchac.

H.4.12. The record of 5-day biochemical oxygen demand (BOD_5) measurements for the Lake Maurepas sampling station averages 1.4 mg/L; individual observations range from 0.0 to 8.3 mg/L. BOD_5 was not measured for the Pass Manchac sampling location. The mean chemical oxygen demand (COD) for the Pass Manchac data is about twice the average of the data for Lake Maurepas. The COD data for the Lake Maurepas sampling station range from 5 mg/L to 95 mg/L and average about 30 mg/L. COD data for the Pass Manchac sampling station average about 60 mg/L and range from zero to 175 mg/L. The periods of record of COD observations differ for the two sampling stations. However, the higher mean COD for the Pass Manchac sampling station is most likely reflective of the influence of brackish inflows from Lake Pontchartrain. The two records of total organic carbon (TOC) measurements are generally similar. The mean of the TOC for Lake Maurepas is 9.3 mg/L-C; these data range from 3.2 mg/L-C to 25.0 mg/L-C. The average of the TOC data for Pass Manchac is slightly lower than for Lake Maurepas - about 7.3 mg/L-C. Observations of TOC concentrations for the Pass Manchac sampling location have ranged from 2.2 mg/L-C to 14.0 mg/L-C.

H.4.13. Total alkalinity measurements (a measure of buffer capacity) average about 23 mg/L for the Lake Maurepas data and about 33 mg/L for the Pass Manchac data. The Environmental Protection Agency's quality criteria for water recommend 20 mg/L alkalinity (as calcium carbonate) as a desirable minimum in fresh water. Using this criterion, and examining the distributions of total alkalinity measurements, suggests that the waters of Lake Maurepas are not too well buffered. About 33 percent of the total alkalinity measurements were less than the 20 mg/L criterion. In contrast, only about seven percent of the total alkalinity data record for the Pass Manchac sampling location indicated concentrations less than 20 mg/L-$CaCO_3$. Again, the apparent higher total alkalinity at the Pass Manchac sampling station probably results from higher relative concentrations of brackish water salts at this location.

H.4.10. Because of the close proximity of the two waterbodies, data for many general water quality parameters are quite similar for the two sampling locations. However, significant differences in the computed means of some constituents likely result from the relative influence of periodic tidal inflow from Lake Pontchartrain to Lake Maurepas via Pass Manchac.

H.4.11. Measured water temperatures of both locations averaged about 21.3 °C over the respective periods of record, and the distributions of individual water temperature measurements at the two locations are almost identical. During each of the respective periods of record, one water temperature measurement at each location was recorded that was higher than the 32.0 °C state standard. The mean of the dissolved oxygen record for the Lake Maurepas sampling location is 8.2 mg/L. None of the dissolved oxygen measurements at this location were below the 5.0 mg/L state standard. The average of the dissolved oxygen record for the Pass Manchac sampling station is 8.3 mg/L. Two of the 61 dissolved oxygen measurements at this location were less than the 5.0 mg/L state standard. The comparisons of measured dissolved oxygen concentrations with computed dissolved oxygen saturation values were made for concurrent temperature-dissolved oxygen measurements for each location. The results of those comparisons indicate that dissolved oxygen content as a percentage saturation averages about 97.7 percent for the Lake Maurepas data and about 91.0 percent for the Pass Manchac data. Three (9%) of the 32 concurrent temperature-dissolved oxygen measurements for Lake Maurepas indicate dissolved oxygen concentrations outside of the normally desirable 80 to 120% of saturation range. Similarly, review of the 61 concurrent temperature -dissolved oxygen measurements for Pass Manchac showed twelve (20%) dissolved oxygen concentrations outside of the normally desirable 80 to 120% of saturation range.

TABLE H-4-5 (Continued)

MEASURES OF GENERAL WATER QUALITY - LAKE MAUREPAS AND PASS MANCHAC

	Middle of Lake Maurepas Near Manchac, LA [1/]	Pass Manchac, East of U. S. Highway 51 [2/]
Total Chloride, mg/L		
Number of Observations	140	57
Mean	160	853
Range	7-1,200	19-3,550
Period of Record	4/75-1/81	3/78-4/83
Total Sulfate, mg/L		
Number of Observations	139	50
Mean	28	106
Range	3-180	10-483
Period of Record	4/75-1/81	3/78-4/83
Salinity, ppt		
Number of Observations	140	57
Mean	0.3	1.6
Range	0.0-2.2	0.1-6.4
Period of Record	4/75-1/81	3/78-4/83
Total Non-filterable Residue, mg/L		
Number of Observations	94	56
Mean	19	26
Range	0-376	0-156
Period of Record	4/77-1/81	3/78-4/83
Turbidity, JTU		
Number of Observations	135	58
Mean	21	20
Range	2-220	2-135
Period of Record	4/75-9/80	3/78-4/83
Color, PT-CO units		
Number of Observations	138	60
Mean	52	36
Range	3-160	10-80
Period of Record	4/75-9/80	3/78-4/83
Nitrite plus Nitrate, ug/L-N		
Number of Observations	138	60
Mean	219	131
Range	0-1,300	10-520
Period of Record	4/75-1/81	3/78-4/83
Total Phosphorus, ug/L-P		
Number of Observations	138	59
Mean	142	93
Range	10-1,700	20-330
Period of Record	4/75-1/81	3/78-4/83

1/ Middle of Lake Maurepas near Manchac, LA (112WRD 301500090300000) 4/75 to 1/81. About one third of the data (about 50 samples) were accumulated during the period April 16, 1979 to June 14, 1979.

2/ Pass Manchac, East of U. S. Highway 51 (21LA10PS B041705010) 3/78-4/83. Samples have been collected at approximately one month intervals over the period of record.

TABLE H-4-5

MEASURES OF GENERAL WATER QUALITY - LAKE MAUREPAS AND PASS MANCHAC

	Middle of Lake Maurepas Near Manchac, LA 1/	Pass Manchac, East of U. S. Highway 51 2/
Water Temperature °C		
Number of Observations	33	61
Mean	21.3	21.3
Range	7.5-32.5	6.5-34.0
Period of Record	4/75-5/77	3/78-4/83
Dissolved Oxygen, mg/L		
Number of Observations	134	61
Mean	8.2	8.3
Range	5.4-13.2	4.1-12.5
Period of Record	4/75-1/81	3/78-4/83
Dissolved Oxygen Saturation, %		
Number of Observations	32	61
Mean	97.7	91.0
Range	78.4-130.8	50.0-123.0
Period of Record	4/75-5/77	3/78-4/83
5-Day Biochemical Oxygen Demand, mg/L		
Number of Observations	131	-
Mean	1.4	-
Range	0.0-8.3	-
Period of Record	4/75-1/81	-
Total Organic Carbon, mg/L-C		
Number of Observations	129	47
Mean	9.3	7.3
Range	3.2-25.0	2.2-14.0
Period of Record	4/75-1/81	10/78-4/83
Chemical Oxygen Demand (High Level) mg/L		
Number of Observations	111	52
Mean	30	60
Range	5-95	0-175
Period of Record	1/76-1/81	3/78-4/83
pH, field, standard units		
Number of Observations	140	61
Mean	7.1	7.1
Range	6.1-7.9	6.5-8.0
Period of Record	4/75-1/81	3/78-4/83
Total Alkalinity, mg/L as $CaCO_3$		
Number of Observations	140	55
Mean	23	33
Range	2-59	17-59
Period of Record	4/75-1/81	3/78-4/83
Total Dissolved Solids, mg/L		
Number of Observations	-	54
Mean	-	1,631
Range	-	20-6,846
Period of Record	-	3/78-4/83

H.4.7. Major tributaries draining into Lake Pontchartrain are the Tangipahoa and Tchefuncta Rivers, Lake Maurepas, and Bayous Lacombe, Bonfouca, and Castine. The Bonnet Carre' Spillway serves as an intermittent source of inflow when used for flood control on the Mississippi River. The drainage systems of Jefferson and Orleans Parishes discharge storm flows into the Lake on the south shore. Tributaries discharging into Lake Maurepas include the Blind, Amite, and Tickfaw Rivers. Pass Manchac links Lake Maurepas to Lake Pontchartrain. It is estimated that discharges from Lake Maurepas and its tributaries, and the Tangipahoa and Tchefuncta Rivers account for about 90% of Lake Pontchartrain's freshwater tributary inflow (Stone, 1980).

H.4.8. Rigolets and Chef Mentuer Pass are natural distributaries of Lake Pontchartrain which discharge to Lake Borgne. The Inner Harbor Navigation Canal, the Intracoastal Waterway, and the Mississippi River Gulf Outlet are manmade navigable waterways that interlink the Mississippi River, the Gulf of Mexico, and Lake Pontchartrain for commercial shipping operations.

LAKE MAUREPAS/PASS MANCHAC

H.4.9. Data for the general water quality characterization of Lake Maurepas and Pass Manchac are presented in table H-4-5. Summary statistics for data spanning approximately six years (April 1975 to January 1981) are shown for a sampling station located at the approximate center of Lake Maurepas. Similarly, descriptive statistics for data accumulated over a period of about five years - March 1978 to April 1983 - are shown for a sampling station located in Pass Manchac east of U. S. Highway 51. The Lake Maurepas station has been sampled by the US Geological Survey-Water Resources Division. The Louisiana Department of Natural Resources-Water Pollution Control Division (LDNR-WPCD) currently samples the Pass Manchac station approximately monthly.

macronutrients and micronutrients, that is, chemicals necessary for the growth and reproduction of rooted or floating flowering plants, ferns, algae, fungi, or bacteria. Two macronutrient forms are particularly significant in the quality characterization of a water body: un-ionized ammonia because of its toxicity to aquatic life, and phosphate because of its role in the accelerated aging and enriching (eutrophication) of lakes and estuaries. In the quality criteria for water, EPA recommends that un-ionized ammonia concentrations not exceed 20 ug/L in fresh waters for protection of aquatic life. To prevent development of biological nuisances and to control accelerated or cultural eutrophication, EPA recommends that total phosphate as phosphorus not exceed 50 ug/L in any stream at the point where it enters any lake or reservoir. The recommended criteria state further that total phosphorus should not exceed 100 ug/L in streams or other flowing waters not discharging directly into lakes or impoundments. Un-ionized ammonia concentrations computed from total ammonia, temperature, and pH data for the Mississippi River at New Orleans exceeded the EPA criteria in 80 of 337 samples (24 percent). Over the period of record, ninety-two percent of the total phosphate observations for the reach of the river investigated exceeded the 50 ug/L criterion, and 94 percent of the total phosphorus observations exceeded the 100 ug/L criterion. Plate H-7 presents period of record tabular and graphic criteria exceedance summaries for these constituents.

LAKE PONTCHARTRAIN BASIN

H.4.6. The Lake Pontchartrain Basin consists of the tributaries and distributaries of Lake Pontchartrain. Lake Pontchartrain is a brackish natural lake in southeast Louisiana and has a tributary drainage area of approximately 4,900 square miles.

TABLE H-4-4

MICRONUTRIENT CONCENTRATIONS IN THE MISSISSIPPI RIVER*

	Number of Samples	Range of Concentrations** Mean	Maximum	Minimum
Boron, dissolved	20	78	463	22
Chromium, dissolved	139	2	20	0
Cobalt, dissolved	67	4	17	0
Copper, dissolved	283	6	130	0
Manganese, dissolved	65	12	120	0
Molybdenum, dissolved	20	29	84	10
Silica, dissolved	685	7.3	15	0.2
Vanadium, dissolved	80	6	34	0
Zinc, dissolved	522	15	190	0

* Concentrations are ug/L

** Period of record mean, maximum and minimum values.

TABLE H-4-7

MEASURES OF GENERAL WATER QUALITY -TCHEFUNCTA RIVER

	Tchefuncta River at U. S. Highway 190 Bridge 1/	Tchefuncta River at at Highway 22 Bridge 2/
Water Temperature, ^{o}C		
Number of Observations	344	61
Mean	18.4	20.1
Range	3.0-33.5	6.5-30.5
Period of Record	6/58-4/83	3/78-4/83
Dissolved Oxygen, mg/L		
Number of observations	286	61
Mean	8.5	6.0
Range	4.0-15.4	1.1-11.4
Period of Record	1/63-4/83	3/78-4/83
Dissolved Oxygen Saturation, %		
Number of Observations	286	61
Mean	87.7	63.0
Range	49.0-137	14.0-96.0
Period of Record	6/58-4/83	3/78-4/83
5-Day Biochemical Oxygen Demand, mg/L		
Number of Observations	47	-
Mean	1.6	-
Range	0.0-4.1	-
Period of Record	3/74-1/83	-
Total Organic Carbon, mg/L-C		
Number of Observations	64	43
Mean	4.2	7.3
Range	0.0-12.2	1.7-14.2
Period of Record	10/78-4/83	10/78-4/83
Chemical Oxygen Demand (High Level), mg/L		
Number of Observations	37	38
Mean	26	55
Range	0-108	0-136
Period of Record	4/78-4/83	4/78-4/83
pH, field, standard units		
Number of Observations	370	61
Mean	6.1	6.6
Range	4.2-7.9	5.6-7.8
Period of Record	6/58-4/83	3/78-4/83
Total Alkalinity, mg/L as $CaCO_3$		
Number of Observations	341	33
Mean	61	20
Range	0-83	2-59
Period of Record	10/58-4/83	3/78-4/83
Total Dissolved Solids, mg/L		
Number of Observations	247	40
Mean	61	986
Range	0-852	42-3782
Period of Record	10/58-4/83	3/78-4/83

TABLE H-4-7 (Continued)

MEASURES OF GENERAL WATER QUALITY -TCHEFUNCTA RIVER

	Tchefuncta River at U. S. Highway 190 Bridge 1/	Tchefuncta River at at Highway 22 Bridge 2/
Total Chloride, mg/L		
Number of Observations	353	49
Mean	8	409
Range	2-166	2-1910
Period of Record	6/58-4/83	3/78-4/83
Total Sulfate, mg/L		
Number of Observations	255	28
Mean	3	66
Range	0-33	0-275
Period of Record	10/58-4/83	3/78-4/83
Salinity, ppt		
Number of Observations	-	49
Mean	-	0.8
Range	-	0.1-3.5
Period of Record	-	3/78-4/83
Total Non-filterable Residue, mg/L		
Number of Observations	178	40
Mean	17	13
Range	0-200	0-34
Period of Record	5/66-4/83	3/78-4/83
Turbidity, JTU		
Number of Observations	320	55
Mean	22	14
Range	2-110	2-63
Period of Record	6/58-4/83	3/78-4/83
Color, PT-CO units		
Number of Observations	338	59
Mean	27	51
Range	5-110	10-160
Period of Record	6/58-4/83	3/78-4/83
Nitrite plus Nitrate, ug/L-N		
Number of Observations	99	60
Mean	255	151
Range	10-1,100	10-650
Period of Record	11/77-4/83	3/78-4/83
Total Phosphorus, ug/L-P		
Number of Observations	103	58
Mean	102	89
Range	20-350	20-210
Period of Record	11/77-4/83	3/78-4/83

1/ Tchefuncta River at U. S. Highway 190 Bridge (21LA1ORS 9201, 6/58-2/78; 21LA1ORS S042200010, 3/78-4/83; 112WRD 07375050, 10/58-1/83)

2/ Tchefuncta River at Highway 22 Bridge (21LA1ORS S042200020) 3/78-4/83

aggregation of data. Water quality monitoring has been conducted at the Highway 190 location by both the US Geological Survey-Water Resources Division and the LDNR-WPCD. The other sampling station selected is located downstream on the Tchefuncta River at the Highway 22 bridge at Madisonville, Louisiana. Water sampling at this location is conducted on a monthly basis by the LDNR-WPCD.

H.4.27. The sample means for the various parameters listed in the table suggest distinctly dissimilar water quality at the two sampling locations. The data shown for the Tchefuncta River at Highway 22 most probably reflect influences of both periodic brackish water inflow from Lake Pontchartrain, as well as local storm and wastewater discharge.

H.4.28. The means of the water temperature data are 18.4 ^{o}C and 20.1 ^{o}C for the US Higway 190 (upstream) and Highway 22 (downstream) sampling locations, respectively. Individual water temperature observations range from 3.0 ^{o}C to 33.5 ^{o}C for the upstream location and 6.5 ^{o}C to 30.5 ^{o}C for the downstream sampling station. Only two of 344 water temperature measurements made at the upstream sampling location and only one of 61 at the downstream station were greater than the 30 ^{o}C state standard.

H.4.29. The average of the dissolved oxygen data for the upstream sampling location is about 8.5 mg/L. The distribution of dissolved oxygen observations at this location ranges from 4.0 mg/L to 15.4 mg/L. Only one of the 286 dissolved oxygen observations recorded was less than the 5.0 mg/L state standard. A distinctly poorer record of measured dissolved oxygen concentrations has been accumulated for the Highway 22 (downstream) sampling station. The mean of the dissolved oxygen data for this location is about 6.0 mg/L; the individual observations range from 1.1 mg/L to 11.4 mg/L. About 36% of the record of dissolved oxygen concentrations were less than the 5.0 mg/L state

standard; about 18% were less than 4.0 mg/L and about 5% less than 3.0 mg/L. Naturally, the mean values of measured dissolved oxygen as a percentage of saturation are similarly disparate, about 87.7% for the upstream sampling location and about 63.0% at the downstream station. At the upstream sampling location, about two percent of the data indicate dissolved oxygen concentrations greater than 120% of saturation and about 17% suggest dissolved oxygen concentrations less than 80% saturation. About 82 percent of the record of percentage of saturation values for the downstream sampling station imply dissolved oxygen concentrations below 80% of saturation.

H.4.30. Five-day biochemical oxygen demand (BOD_5) data are only available for the selected upstream (US Higway 190) sampling location. Measured BOD_5 concentrations ranged from 0.0 to 4.1 mg/L and average 1.6 mg/L for the period March 1974 to January 1983. Chemical oxygen demand (COD) data range from zero to 108 mg/L and average about 26 mg/L for the upstream sampling location. The mean of the COD data for the downstream (Highway 22) sampling station is more than twice as great at about 55 mg/L. These data range from zero to 136 mg/L. Sample means for total organic carbon measurements are 4.2 mg/L-C and 7.3 mg/L for the upstream and downstream sampling locations, respectively.

H.4.31. Sample means of pH measurements are 6.1 su for the upstream sampling location and 6.6 su for the downstream sampling station. About 35 percent of the pH record for the upstream (US Highway 190) sampling location indicate pH measurements below the 6.0 su state standard. However, a trend plot of these data shows that the frequency of measured low pH values is decreasing for this location. Since 1978, pH data accumulated indicate about 16 percent of the observations below the state standard. Approximately ten percent of the pH observations made at the downstream sampling station are less than the minimum state standard. All of these data were accumulated from March 1978 to

April 1983. The total alkalinity data suggest that waters of the Tchefuncta River, like those of Lake Maurepas and the Tangipahoa River, are not well buffered. The total alkalinity measurements average about 12 mg/L-$CaCO_3$ and range from zero to 83 mg/L -$CaCo_3$ for the upstream sampling location. Observations of total alkalinity for the downstream sampling station average about 20 mg/L-$CaCO_3$ and range from 2 to 59 mg/L-$CaCO_3$. Periodic brackish water inflows from Lake Pontchartrain are probably reflected in the higher mean total akalinity of this sampling station compared to the upstream sampling location. Still, about 55 percent of the total alkalinity data for the downstream sampling location are less than 20 mg/L-$CaCO_3$.

H.4.32. Observations of total dissolved solids (TDS), total chloride (CL), and total sulfate (SO_4) concentrations average about 61 mg/L, 8 mg/L, and 3 mg/L, respectively, for the upstream sampling location. Approximately eleven percent of the TDS data, about three percent of the chloride data, and about five percent of the sulfate data for this location exceed applicable state standards. Sample means of TDS, CL, and SO_4 data are considerably greater for the downstream sampling station at about 986 mg/L, 409 mg/L, and 66 mg/L, respectively. About 83% of the TDS data, about 82% of the CL data, and about 79% of the SO_4 data exceed applicable state standards. Salinity, computed from chloride concentrations, average 0.8 ppt and range from 0.0 to 3.5 ppt at this location.

H.4.33. Observations of total nonfilterable residue (suspended solids), turbidity, and true color made for the upstream sampling location average about 17 mg/L, 22 JTU, and 27 PT-CO units, respectively. Corresponding sample means for the downstream sampling location are 13 mg/L, 14 JTU, and 51 PT-CO units.

H.4.34. Nitrite plus nitrate concentrations average about 255 ug/L-N for the upstream sampling location and about 151 ug/L-N for the downstream sampling station. Observed total ammonia (NH_3 + NH_4) concentrations average about 74 ug/L-N and computed un-ionized ammonia (NH_3) concentrations average about 0.1 ug/L-N for the upstream sampling location. Total ammonia concentrations as high as 270 ug/L-N have been measured; however, the generally acidic conditions preclude formation of high concentrations of toxic un-ionized ammonia. No ammonia data were available for the downstream sampling station. Sample means for total phosphorus concentrations are 102 ug/L-P and 89 ug/L-P for the upstream and downstream sampling locations, respectively.

LAKE PONTCHARTRAIN

H.4.35. Water quality data used to assess the general character of Lake Pontchartrain are presented in table H-4-8. Descriptive statistics for fourteen general water quality parameters measured at twelve sampling locations within the lake and major outlet passes are shown. Additionally, aggregate summary statistics for the twelve distinct sampling locations are provided.

TABLE H-4-8

MEASURES OF GENERAL WATER QUALITY - LAKE PONTCHARTRAIN

	STATION NUMBER												
	1	2	3	4	5	6	7	8	9	10	11	12	12 Station Aggregate Summary
Water Temperature, °C													
Number of Observations	-	51	43	43	44	-	61	-	61	-	39	41	383
Mean	-	20.4	20.3	20.4	20.7	-	20.3	-	20.6	-	20.1	20.1	20.4
Range	-	7.0-33.0	7.5-33.0	9.5-32.0	8.0-30.5	-	6.3-32.0	-	6.0-32.0	-	8.0-31.5	7.5-32.5	6.0-33.0
Period of Record	-	1/75-1/83	1/75-5/77	1/17-5/77	1/75-5/77	-	3/78-4/83	-	3/78-4/83	-	1/75-6/76	1/75-6/76	1/75-4/83
Dissolved Oxygen, mg/L													
Number of Observations	50	167	156	155	157	69	60	69	60	50	158	153	1,304
Mean	7.8	8.4	7.9	8.0	8.4	8.2	8.1	8.3	8.2	8.1	8.8	9.0	8.4
Range	6.5-9.0	4.4-13.0	1.2-12.4	3.7-13.4	3.9-14.2	6.5-11.4	4.9-12.1	6.4-11.3	4.9-13.0	6.9-11.5	6.0-13.6	6.4-13.6	1.2-14.2
Period of Record	4/79-6/79	6/74-1/83	6/74-1/81	6/74-1/81	6/74-1/81	4/79-1/81	3/78-4/83	4/79-1/81	3/78-4/83	4/79--6/79	6/74-1/81	6/74-1/81	6/74-4/83
Dissolved Oxygen Saturation, %													
Number of Observations	-	49	41	41	43	-	60	-	60	-	38	41	373
Mean	-	91	87	88	91	-	88	-	88	-	95	99	90
Range	-	74-114	47-118	52-139	44.0-113	-	47-114	-	37-117	-	76-119	85-132	37-132
Period of Record	-	1/75-1/83	1/75-5/77	1/75-5/77	1/75-5/77	-	3/78-4/83	-	3/78-4/83	-	1/75-6/76	1/75-6/76	1/75-4/83
5-Day Biochemical Oxygen Demand, mg/L													
Number of Observations	50	162	154	151	152	68	-	67	-	49	155	148	1,156
Mean	0.9	1.6	1.7	1.7	1.9	0.8	-	0.9	-	1.1	1.9	1.8	1.6
Range	0.0-2.4	0.0-6.5	0.2-6.5	0.0-9.0	0.0-7.3	0.0-3.7	-	0.0-2.2	-	0.0-3.9	0.0-11.0	0.0-7.7	0.0-11.0
Period of Record	4/79-6/79	6/74-1/83	6/74-1/81	6/74-1/81	6/74-1/81	6/74-1/81	-	4/79-1/81	-	4/79-6/79	6/74-1/81	6/74-1/81	6/74-1/83
Total Organic Carbon, mg/L-C													
Number of Observations	42	160	147	149	147	56	47	56	41	42	150	141	1,178
Mean	7.4	8.8	8.0	8.9	9.1	6.1	5.4	6.3	5.6	7.0	7.0	7.2	7.6
Range	4.7-22	3.4-25.0	0.0-25.0	1.3-22	2.3-28	4.2-11	0.3-12	4.0-11.0	2.5-25	5.0-16	3.0-31.0	3.6-17.0	0.0-31.0
Period of Record	4/79-6/79	6/74-1/83	6/74-1/81	6/74-1/81	6/74-1/81	6/79-1/81	3/78-4/83	4/79-1/81	10/78-4/83	4/79-6/79	6/74-1/81	6/74-1/81	6/74-4/83
Chemical Oxygen Demand (High Level) mg/L													
Number of Observations	50	119	113	105	99	67	48	68	36	49	91	86	931
Mean	23	47	35	45	65	107	113	73	159	27	87	60	74
Range	6.0-47	5.0-200	5.0-120	9.0-270	9.0-350	8.0-850	8.0-349	7.0-380	20-560	9.0-60	9.0-370	11-270	5.0-850
Period of Record	4/79-6/79	1/76-1/83	1/76-1/81	1/76-1/81	1/76-1/81	4/79-1/81	3/78-4/83	4/79-1/81	4/78-4/83	4/79-6/79	1/76-1/81	4/76-1/81	1/76-4/83

TABLE H-4-8 Continued

MEASURES OF GENERAL WATER QUALITY - LAKE PONTCHARTRAIN

	STATION NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	12 Station Aggregate Summary
pH, field, standard units													
Number of Observations	50	171	160	159	159	69 61	68	61	50	161	156	1,325	
Mean	7.6	7.1	7.1	7.1	7.3	7.6	7.4	7.7	7.5	7.7	7.7	7.5	7.4
Range	6.8-8.1	6.2-8.0	5.8-8.1	5.7-8.3	6.0-8.3	6.4-8.1	6.5-8.2	6.5-8.4	6.7-8.4	7.0-8.4	6.4-8.6	6.4-8.5	5.7-8.6
Period of Record	4/79-6/79	6/74-1/83	6/74-1/81	6/74-1/81	6/74-1/81	4/79-1/81	3/78-4/83	4/79-1/81	3/78-4/83	4/79-6/79	6/74-1/81	6/74-1/81	6/74-4/83
Total Alkalinity, mg/L as $CaCO_3$													
Number of Observations	50	171	160	159	159	69 55	68	33	50	161	156	1,291	
Mean	65	27	24	24	36	49 49	60	48	41	55	36	39	
Range	15-90	11-87	6.0-78	3.0-71	6.0-170	5.0-84	15-326	18-85	31-65	25-59	12-105	11-117	3.0-326
Period of Record	4/79-6/79	6/74-1/81	6/74-1/81	6/74-1/81	6/74-1/81	4/79-1/81	3/78-4/83	4/79-1/81	3/78-4/83	4/79-6/79	6/74-1/81	6/74-1/81	6/74-4/83
Total Non-filterable Residue, mg/L													
Number of Observations	50	99	93	90	87	68 56	68	40	48	92	89	880	
Mean	57	27	25	18	18	21 28	22	21	17	21	20	24	
Range	0-263	0-270	0-334	0-148	0-178	0-99	0-230	2-154	2-70	0-88	0-90	0-190	0-334
Period of Record	4/79-6/79	5/77-10/82	4/77-1/81	4/77-1/81	4/77-1/81	4/79-1/81	3/78-4/83	4/79-1/81	3/78-4/83	4/79-6/79	4/77-1/81	4/77-1/81	4/77-1/83
Turbidity, JTU													
Number of Observations	50	151	148	147	147	65 58	64	55	50	149	145	1,229	
Mean	53	22	21	15	11	23 15	20	13	15	17	15	19	
Range	10-150	2-80	1-150	1-100	2-70	2-75	2-65	0-65	2-63	4-40	0-60	1-100	0-150
Period of Record	4/79-6/79	10/74-9/80	10/74-9/80	10/74-9/80	10/74-9/80	4/79-9/80	3/78-4/83	4/79-1/81	3/78-4/83	4/79-6/79	10/74-9/80	10/74-7/80	10/74-4/83
True Color, PT-CO units													
Number of Observations	50	170	160	157	158	69 60	68	59	50	159	155	1,315	
Mean	31	42	39	42	27	20 21	17	19	22	16	19	28	
Range	5-120	0-160	0-100	0-140	0-130	0-50	5-60	0-50	5-50	5-50	0-60	0-120	0-160
Period of Record	4/79-6/79	6/74-1/83	6/74-1/81	6/74-1/81	6/74-1/81	4/79-1/81	3/78-4/83	4/79-1/81	3/78-4/83	4/79-6/79	6/74-1/81	6/74-1/81	6/76-1/83
Nitrite plus Nitrate, ug/L-N													
Number of Observations	50	162	152	148	148	67 60	67	60	49	152	144	1,259	
Mean	1,233	237	229	159	133	524	80	756	87	351	557	154	316
Range	15-1,900	0-1,400	0-1,400	0-1,300	0-1,600	0-1,700	10-1,300	0-1,700	5,1,520	10-1,200	0-1,900	0-2,500	0-2,500
Period of Record	4/79-6/79	10/74-1/83	10/74-1/81	10/74-1/81	10/74-1/81	4/79-1/81	3/78-4/83	4/79-1/81	3/78-4/83	4/79-6/79	10/74-1/81	10/74-1/81	10/74-4/83

TABLE H-4-8 Continued

MEASURES OF GENERAL WATER QUALITY - LAKE PONTCHARTRAIN

	STATION NUMBER												
	1	2	3	4	5	6	7	8	9	10	11	12	12 Station Aggregate Summary
Total Phosphorus, ug/l-P													
Number of Observations	50	171	160	157	156	61	59	67	58	49	160	154	1,302
Mean	130	50	20	100	110	60	70	70	90	40	110	120	110
Range	10-430	10-4,200	10-1,000	10-1,100	10-2,500	5-140	20-350	20-250	20-620	20-70	10-2,700	10-2,500	5-4,200
Period of Record	4/79-6/79	6/74-1/83	6/74-1/81	6/74-1/81	6/74-1/81	4/79-1/81	3/78-4/83	4/79-1/81	3/78-4/83	4/79-6-79	6/74-1/81	6/74-1/81	6/74-4/83
Salinity, ppt													
Number of Observations	50	170	159	159	156	69	57	68	57	49	161	154	1,309
Mean	0.3	0.9	0.7	1.2	2.2	3.6	4.9	3.9	5.8	0.9	3.4	2.4	2.5
Range	0.1-1.3	0.1-5.1	0.0-4.4	0.0-4.7	0.1-6.2	0.1-9.6	0.4-12.7	0.1-1.0	0.2-12.9	0.4-2.0	0.1-13.6	0.1-6.5	0.0-13.6
Period of Record	4/79-6/79	6/74-10/82	6/74-1/81	6/74-1/81	6/74-1/81	4/79-1/81	3/78-12/82	4/79-1/81	3/78-12/82	4/79-6/79	6/74-1/81	6/74-1/81	6/74-12/82

Sampling Stations:

1/ Lake Pontchartrain 9.8 miles NNW of Kenner, LA (112WRD 300922090171500) 4/79-6/79. Temporary sampling station for water quality monitoring during 1979 diversion of flood flows through the Bonnet Carre' Floodway.

2/ Lake Pontchartrain at Pass Manchac, near Manchac, LA (112WRD 301730090180000) 6/74-1/83. Approximately one-third of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

3/ Lake Pontchartrain at Mouth of Tangipahoa River, near Lee Landing (112WRD 301945090161500) 6/74-1/81. Approximately one-third of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

4/ Lake Pontchartrain at Mouth of Tchefuncta River, near Madisonville, LA (112WRD 302150090102000) 6/74-1/81. Approximately one-third of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

5/ Lake Pontchartrain at Mouth of Bayou LaCombe, near LaCombe, LA (112WRD 301500089572000) 6/74-1/81. Approximately one-third of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

6/ Lake Pontchartrain at West Rigolets, 5.7 miles SSE of Slidell, LA (112WRD 301015089451500) 4/79-1/81. Approximately 70 percent of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

7/ Pass Rigolets at US Highway 90 Bridge (21LA1ORS B041708010) 3/78-4/83.

8/ Lake Pontchartrain 2.2 miles NNW of Chef Menteur, LA (112WRD 300555089490300) 4/79-1/81. Approximately 70 percent of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows throuh the Bonnet Carre' Floodway.

9/ Chef Menteur Pass at US Highway 90 Bridge (21LA1ORS S040615010) 3/78-4/83.

10/ Lake Pontchartrain 0.9 miles North of Pointe Aux Herbes, LA (112WRD 301000089510000) 4/79-6/79. Temporary sampling station for water quality monitoring during 1979 diversion of flood flows through the Bonnet Carre' Floodway.

11/ Lake Pontchartrain at Inner Harbor Navigation Canal (112WRD 300205090015500) 6/74-1/81. Approximtely one-third of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

12/ Lake Pontchartrain at Mid Causeway (112WRD 301116090073300) 6/74-1/81. Approximately one-third of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

H.4.36. The sampling locations designated in the table are as follows:

Sampling Station Number	Location
1	Lake Pontchartrain 9.8 miles NNW of Kenner, Louisiana
2	Lake Pontchartrain at Pass Manchac near Manchac, Louisiana
3	Lake Pontchartrain at the mouth of the Tangipahoa River near Lee Landing, Louisiana
4	Lake Pontchartrain at the mouth of the Tchefuncta River near Madisonville, Louisiana
5	Lake Pontchartrain at the mouth of Bayou LaCombe near LaCombe, Louisiana
6	Lake Pontchartrain at West Rigolets, 5.7 miles SSE of Slidell, Louisiana
7	Pass Rigolets at the US Highway 90 Bridge
8	Lake Pontchartrain 2.2 miles NNW of Chef Menteur, Louisiana

9	Chef Menteur Pass at the US Highway 90 Bridge
10	Lake Pontchartrain 0.9 miles north of Pointe Aux Herbes, Louisiana
11	Lake Pontchartrain at the Inner Harbor Navigation Canal at New Orleans, Louisiana
12	Lake Pontchartrain at Mid-Causeway

H.4.37. Approximately one-third of the data available for sampling stations 2,3,4,5,11, and 12; about 70 percent of the data for stations 6 and 8; and all of the data for stations 1 and 10 were accumulated during the two-month period from April 16, 1979 to June 14, 1979. About 50 of the total number of samples from each location were collected as part of an intensive water quality monitoring effort during and immediately after diversion of flood waters through the Bonnet Carre' Floodway. Although these data were accumulated during what might be considered an unusual event, such events will continue to occur in the future and should be considered in a presentation of existing conditions. In order to avoid bias, April, May, June 1979 observations were first converted to three-month averages. These values were then weighted proportionately (number of months) to the mean parameter level of remainder of a station's observations during its period of record. The aggregate mean values were determined by weighting each stations's mean in proportion to its record length. Data accumulated before and after

he intensive survey period are the result of, roughly, monthly sample ollections at the noted locations. Generally, samples have been ollected monthly, from March 1978 to the present, at sampling stations and 9.

.4.38. The computed mean values of the listed parameters are more or ess consistent for the twelve sampling locations. In general, the ample means of water temperature observations are about 20°C and those or dissolved oxygen, with some exceptions, about 8 mg/L. The istribution of water temperature sample means ranges from 20.1°C to 0.6°C and actual recorded water temperatures range from 6°C to 33°C. one of the 383 recorded water temperatures were above the 35°C state tandard for the lake. Distributions of surface water temperatures easured in western Lake Pontchartrain are shown in table H-4-9. The ighest mean dissolved oxygen concentration, 8.7 mg/L, was computed from ata for sampling stations at the Inner Harbor Navigation Canal station 11) and at mid-lake at the Causeway (station 12). The lowest ean dissolved oxygen concentration, 7.6 mg/L, was computed from data or sampling stations located near the Tangipahoa and Tchefuncta ivers. Dissolved oxygen concentrations below the 4.0 mg/L state tandard have been noted in the lake near the Tangipahoa and Tchefuncta ivers and Bayou LaCombe (sampling stations 3,4, and 5, respectively). our of the 156 observations for station 3, five of the 155 observations or station 4, and one of the 157 observations for station 5 was less han the state dissolved oxygen standard.

.4.39. Evaluation of measured dissolved oxygen concentrations as a ercentage of computed dissolved oxygen saturation values suggest that oncentrations greater than 120 percent of saturation have occurred, but nfrequently. For both the mid-lake sampling station (station 12) and he sampling station near the Tchefuncta River (station 4), two of 41 oncurrent dissolved oxygen/water temperature measurements imply issolved oxygen concentrations greater than 120 percent of

TABLE II-4-9

SURFACE WATER TEMPERATURE[1/] - LAKE PONTCHARTRAIN

North End of Causeway[2/]

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Number of Observations	73	75	73	124	141	136	108	105	118	136	115	101
Mean (logarithmic)	11.0	12.1	15.5	20.4	25.3	28.7	29.7	29.2	27.7	23.0	17.8	12.4
Range	6.1-15.6	6.1-17.8	5.6-22.8	13.0-25.6	19.4-30.6	22.8-32.9	25.6-33.3	24.4-33.9	22.3-32.8	15.6-30.0	9.7-25.0	5.3-17.8
Weighted Percentiles[4/]												
5	7.5	6.7	10.4	15.3	22.2	26.1	27.2	25.6	24.4	18.2	13.1	7.8
10	8.3	8.4	12.2	17.3	22.9	27.2	28.2	26.6	25.6	19.4	14.4	8.9
20	9.8	8.4	13.9	18.3	23.4	27.8	28.9	27.8	26.1	21.0	15.6	10.0
30	10.0	11.7	14.4	18.9	24.0	28.3	29.4	28.5	26.7	21.7	16.7	11.1
40	10.9	12.2	15.0	19.9	25.0	28.9	29.4	28.9	26.7	22.2	17.8	12.8
50 (median)	11.5	12.8	16.1	20.6	25.6	28.9	30.0	29.4	27.8	22.8	18.3	12.8
60	11.7	12.8	16.7	21.4	26.1	29.0	30.0	30.0	28.3	23.9	18.9	13.3
80	12.8	15.0	18.3	22.8	27.2	30.0	31.1	30.6	29.4	26.1	20.0	15.0
90	13.4	16.0	18.9	24.2	27.8	30.6	31.7	31.3	30.6	27.4	22.2	16.0
95	15.6	16.7	19.5	24.7	28.3	30.6	32.2	32.2	31.1	28.3	23.4	16.1

South End of Causeway[3/]

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Number of Observations	202	166	220	236	250	237	254	284	258	239	276	270
Mean (logarithmic)	11.7	12.2	16.3	21.7	25.3	28.9	30.1	30.0	28.0	24.0	18.3	13.7
Range	6.7-18.3	50-17.1	9.4-25.6	14.4-29.4	15.6-32.8	19.7-33.9	23.9-32.0	25.6-34.4	21.1-34.4	15.6-33.9	9.8-26.1	5.6-21.7
Weighted Percentiles[3/]												
5	8.3	9.5	11.7	16.7	20.6	25.6	26.8	26.8	23.3	18.3	13.3	8.7
10	9.4	10.0	12.8	18.1	21.7	26.7	27.8	27.8	25.6	20.6	15.0	10.2
20	10.0	10.3	13.9	18.9	23.5	27.8	28.3	28.3	23.7	21.7	16.1	11.7
30	10.6	11.1	15.0	20.0	24.4	28.3	28.9	28.9	26.7	22.2	17.2	12.8
40	11.1	11.7	15.8	21.1	25.0	28.9	29.4	29.4	27.2	23.3	17.8	13.3
50 (median)	12.2	12.2	16.7	22.2	25.6	29.0	30.0	30.0	27.8	24.4	18.3	13.9
60	12.2	12.8	17.2	22.8	26.1	29.4	30.6	30.6	28.3	25.0	19.0	14.5
80	13.5	14.4	18.9	25.0	27.8	30.0	31.7	31.7	30.0	26.7	21.1	16.7
90	14.8	15.6	20.6	25.8	28.3	31.1	32.8	33.3	32.2	27.8	22.2	17.2
95	15.6	15.7	21.7	26.7	29.4	32.2	33.3	33.3	33.3	29.4	23.3	18.3

1/ All values are degrees Celsius
2/ Lake Pontchartrian at North End of Causeway (11COELMN 85683) 10/57 to 12/77.
3/ Lake Pontchartrain at South End of Causeway (11COELMN 85613) 10/57 to 12/77.
4/ Distributions of daily surface water temperatures.

tion. The data infer that, more frequently, dissolved oxygen
itrations computed to be less than 80 percent of saturation have
ieasured. Dissolved oxygen concentrations computed to be less than
cent of saturation have been recorded for all but one of the
ng locations for which concurrent dissolved oxygen/water
ature measurements have been made. Eight percent of the
rent measurements from sampling at Pass Manchac (station 2) and
iner Harbor Navigation Canal (station 11) suggest dissolved oxygen
itrations less than 80 percent of saturation. Similarly, for
ns 3,4,5,7, and 9 approximately 29%, 32%, 19%, 16%, and 17%
tively, of the concurrent measurements indicate dissolved oxygen
itrations less than 80% of saturation. The absence of water
ature records for sampling stations 7,6,8, and 10 precluded
ison of measured dissolved oxygen concentrations with computed
ition values. The distribution of sample means for dissolved
i as a percentage of saturation ranges from 86.9 percent for the
iear the Tangipahoa River to 99.5 percent for the mid-lake sampling
n. Overall, computed percentages of dissolved oxygen saturation
e 90.5% and range from 36.5% to 139.2%.

). The distribution of sample means for five-day biochemical
i demand ranges from 0.8 mg/L for the West Rigolets sampling
n (station 6) to 1.7 mg/L for sampling stations at Bayou LaCombe
on 5) and the Inner Harbor Navigation Canal (station 11).
tively, five-day biochemical oxygen demand measurements range from
11.0 mg/L and average 1.5 mg/L. The highest recorded biochemical
deamand, 11.0 mg/L, was measured at the sampling station near the
Harbor Navigation Canal. This maximum value is about 22 percent
than the maximum recorded for any of the other sampling
ons.

Measurements of total nonfilterable residue (suspended solids), ty, and true color made for the West Pearl River sampling average about 38 mg/L, 28 JTU, and 35 PT-CO units, vely. Corresponding sample means for the East Pearl River g location are 53 mg/L, 28 JTU, and 35 PT-CO units.

The average of the nitrite plus nitrate data for the West Pearl ampling location is about 180 ug/L-N - about 50% greater than the L-N mean for the East Pearl data. The average of the total rus data for the West Pearl sampling location is about 92 ug/L-P 11% greater than the 83 ug/L-P mean for the East Pearl data.

SSISSIPPI SOUND

General quality statistics for the west Mississippi Sound area wn in table H-4-12. these descriptive statistics result from ted data for samples collected at several locations. Sampling s which provided water quality data for this area are indicated footnote to the table.

As indicated in the table, the sample mean for dissolved oxygen rally comparable to those computed for Lakes Pontchartrain (table and Borgne (table H-4-10) at about 8.7 mg/L. Data for dissolved content as a percentage of saturation average about 101 . About 16 percent of the dissolved oxygen data suggest rations less than 80% of saturation or greater than 120% of ion.

Evaluation of the pH data suggests only rare instances of d values not with the 6.5 to 9.0 su range. Only about three of the data were less than 6.5 su or greater than 9.0 su. The average about 7.9 su and from 5.3 to 9.3 su.

11.6 mg/L. Approximately 15 percent of the dissolved oxygen observations for the East Pearl River sampling station indicate concentrations below 5.0 mg/L. Sample means for dissolved oxygen as a percentage of saturation are 79.3% for the West Pearl and 72.7% for the East Pearl sampling location, and approximately 64% of the East Pearl data imply concentration less than 80% of saturation.

H.4.56. Chemical oxygen demand (COD) data range from zero to 89 mg/L and average about 31 mg/L for the West Pearl sampling location. The mean of the COD data for the East Pearl sampling location is about 90% greater at about 58 mg/L. These data range from zero to 297 mg/L. Sample means for total organic carbon measurements are 4.8 mg/L-C and 5.8 mg/L-C for the West and East Pearl sampling locations, respectively.

H.4.57. The sample mean of pH measurements at each location is about 6.7 su. Approximately 20 percent of the pH record for the West Pearl River sampling location indicate values less than 6.5 su. Similarly, about 13 percent of the pH record for the East Pearl River sampling location indicated values less than 6.5 su. The total alkalinity data suggest that waters of the West Pearl River are not well buffered. The total alkalinity measurements average about 17 mg/L-$CaCO_3$ and range from 5 to 51 mg/L-$CaCO_3$ for the West Pearl location. The mean of the total alkalinity data for the East Pearl location is marginally better at 25 mg/L-$CaCO_3$. These data range from 6 to 92 mg/L-$CaCO_3$.

H.4.58. Observations of total dissolved solids (TDS), total chloride (CL), and total sulfate (SO_4) concentrations average about 136 mg/L, 34 mg/L and 11 mg/L, respectively, for the West Pearl River sampling location. Sample means of TDS, CL, and SO_4 data are considerably greater for the East Pearl sampling location at about 2,224 mg/L, 1,105 mg/L and 153 mg/L, respectively. Salinity computed from chloride data averages about 1.9 ppt and ranges from 0.0 to 9.3 ppt for the East Pearl River sampling location.

TABLE H-4-11 (Continued)

Measures of General Water Quality-Pearl River

	West Pearl River at Highway 90 Bridge [1]	East Pearl River at Highway 90 Bridge [2]
Total Sulfate, mg/L		
Number of Observations	28	49
Mean	11	153
Range	0-37	0-884
Period of Record	3/78-4/83	3/78-4/83
Salinity, ppth		
Number of Observations	42	52
Mean	0.0	1.9
Range	0.0-1.0	0.0-9.3
Period of Record	3/78-12/82	3/78-12/82
Total Non-filterable Residue, mg/L		
Number of Observations	40	56
Mean	38	53
Range	4-96	0-2,006
Period of Record	3/78-4/83	3/78-4/83
Turbidity, JTU		
Number of Observations	55	58
Mean	28	28
Range	8-72	1-315
Period of Record	3/78-4/83	3/78-4/83
True Color, PT-CO units		
Number of Observations	59	60
Mean	35	35
Range	10-80	10-70
Period of Record	3/78-4/83	3/78-4/83
Nitrite plus Nitrate, ug/L-N		
Number of Observations	60	60
Mean	180	120
Range	10-360	10-340
Period of Record	3/78-4/83	3/78-4/83
Total Phosphorus, ug/L-P		
Number of Observations	58	59
Mean	92	83
Range	10-140	20-600
Period of Record	3/78-4/83	3/78-4/83

1/ West Pearl River at Highway 90 Bridge (21LA1ORS S090465020) 3/78-5/83

2/ East Pearl River at Highway 90 Bridge (21LA1ORS B090465010) 3/78-5/83

TABLE H-4-11

Measures of General Water Quality-Pearl River

	West Pearl River at Highway 90 Bridge [1/]	East Pearl River at Highway 90 Bridge [2/]
Water Temperature, °C		
Number of Observations	61	61
Mean	20.3	20.6
Range	6.0-33.0	6.6-32.0
Period of Record	3/78-4/83	3/78-4/83
Dissolved Oxygen, mg/L		
Number of observations	61	61
Mean	7.4	6.9
Range	5.0-12.1	3.2-11.6
Period of Record	3/78-4/83	3/78-4/83
Dissolved Oxygen Saturation, %		
Number of Observations	61	61
Mean	79.3	72.7
Range	62.0-103.0	44.0-105.0
Period of Record	3/78-4/83	3/78-4/83
Chemical Oxygen Demand, (High Level) mg/L		
Number of Observations	38	52
Mean	31	58
Range	0-89	0-297
Period of Record	4/78-4/83	3/78-4/83
Total Organic Carbon, mg/L-C		
Number of Observations	42	47
Mean	4.8	5.8
Range	1.0-13.0	2 0-11.0
Period of Record	10/78-4/83	10/78-4/83
pH, field, standard units		
Number of Observations	61	61
Mean	6.7	6.7
Range	5.9-8.6	5.9-8.6
Period of Record	3/78-4/83	3/78-4/83
Total Alkalinity, mg/L-$CaCO_3$		
Number of Observations	32	55
Mean	17	25
Range	5-51	6-92
Period of Record	3/78-4/83	3/78-4/83
Total Dissolved Solids, mg/L		
Number of Observations	40	55
Mean	136	2,224
Range	34-480	8-13,322
Period of Record	3/78-4/83	3/78-4/83
Total Chloride, mg/l		
Number of Observations	49	57
Mean	34	1,105
Range	4-235	2-7,705
Period of Record	3/78-4/83	3/78-4/83

PEARL RIVER

H.4.52. Summary statistics which are descriptive of the general quality of the lower Pearl River are shown in table H-4-11. These statistics were derived from data generated from water sampling at two Pearl River locations included in the State of Louisiana water quality monitoring network. One sampling station is located on the West Pearl River at US Highway 90; the other sampling location is on the East Pearl River at the Louisiana-Mississippi state boundary. Monthly water quality sampling has been conducted at the two locations since March 1978.

H.4.53. Generally, the sample means for some parameters indicate significant differences in the character of waters of the two locations. Some summary statistics shown for the East Pearl River appear to reflect the influence of periodic saltwater inflow and possibly local urban storm and wastewater discharge.

H.4.54. The means of the water temperature data are 20.3 ^{o}C and 20.1 ^{o}C for the West Pearl River and East Pearl River, respectively. Individual water temperature observations range form 6.0 ^{o}C to 33.0 ^{o}C for the West Pearl and 6.6 ^{o}C to 32 ^{o}C for the East Pearl River sampling location. The Louisiana State temperature standard for the West Pearl River is 35 ^{o}C.

H.4.55. The average of the dissolved oxygen data for the West Pearl River sampling location is about 7.4 mg/L. The distribution of dissolved oxygen observations for this location range form 5.0 mg/L to 12.1 mg/L. A somewhat poorer record of measured dissolved oxygen concentrations has been accumulated for the East Pearl River sampling location. The mean of the dissolved oxygen data for this location is 6.9 mg/L; the individual observations range from 3.2 mg/L to

H.4.48. As shown in the table, the sample means for dissolved oxygen concentrations are generally comparable to those computed for Lake Pontchartrain. Dissolved oxygen sample means range from about 7.2 mg/L for the IHNC to about 9.4 mg/L for the MR-GO at Breton Sound. About 14 percent of the record of dissolved oxygen observations for the IHNC are less than the 4.0 mg/L state standard for this waterway. Only one dissolved oxygen observation for the GIWW sampling location was below the 4.0 mg/L minimum state standard. None of the dissolved oxygen data for the two MR-GO sampling locations was less than the state standard. The minimum dissolved oxygen standard for the Lake Borgne area is 5.0 mg/L. Approximately four percent of the dissolved oxygen data for this area were less than the state standard.

H.4.49. Sample means of dissolved oxygen content as a percentage of saturation range from about 76.7% for the IHNC to about 94.6% for the Lake Borgne area. About 50% of the dissolved oxygen data for the IHNC indicate concentrations less than 80% of saturation. Similarly, approximately seven percent of the DO data for the GIWW sampling location and about 24% of the data for the Lake Borgne area imply concentrations less than 80% of saturation.

H.4.50. Evaluation of the pH data reveals that measured values outside the 6.5 to 9.0 standard unit range of the state standard are rare. Approximately five percent of the pH data for the Lake Borgne area were outside of 6.5 to 9.0 range. Only one percent of the pH data for the IHNC and MR-GO at Bayou Dupre was outside of the 6.5 to 9.0 range stated in the state standard.

H.4.51. Generally, the highest sample means for total nonfilterable residue (suspended solids), turbidity, true color, nitrite plus nitrate, and total phosphorus were computed for the IHNC. The sample means for these parameters generally decrease with progression to waterbodies located to east and south of the IHNC.

TABLE H-4-10 (CONTINUED)

MEASURES OF GENERAL WATER QUALITY - SOUTH AND EAST LAKE PONTCHARTRAIN BASIN

	IHNC 1/	GIWW at Paris Rd. 2/	MR-GO at Bayou Dupre 3/	MR-GO at mi.-5.0 (Breton Sound)	Lake Borgne 5/
Total Phosphorus, ug/l-P					
Number of Observations	7	119	34	35	9
Mean	189	139	80	55	111
Range	30-310	7-2,700	40-390	10-270	10-400
Period of Record	11/75-7/79	6/74-1/83	1/78-1/81	2/76-1/81	4/75-5/75
Salinity, ppt 6/					
Number of Observations	5,375	118	34	36	785
Mean	7.0	8.4	9.7	24.2	4.9
Range	0.1-25.8	1.0-19.9	3.6-19.9	2.0-37.9	0.1-20.4
Period of Record	2/57-7/79	6/74-10/82	1/78-1/81	6/76-1/81	3/57-5/75

1/ Inner Harbor Navigation Canal. Aggregate of data for eleven sampling locations -21LALDHM: 04124202, 04124202, 04124205; 11COELMN: 76060, 76063, 76120, 76160; 112WRD 295934090005500, 295909090011200, 295808090013200, 295741090014200, 295730090013900.

2/ Gulf Intracoastal Waterway near Paris Rd. (112WRD 300240089560500) 6/74 to 1/83.

3/ Mississippi River Gulf Outlet at Bayou Dupre (112WRD 295623089501800) 1/76 to 1/83.

4/ Mississippi River Gulf Outlet at mile -5.0 - Breton Sound (112WRD 292730089032200) 4/75 to 1/81.

5/ Lake Borgne. Aggregate of data for 22 sampling locations - 21LALDHM: 04134401, 04124403, 04134503; 11COELMN 86201, 86002, 86202, 86001, 85769, 86102, 85828, 85768, 85826, 85778, 86101, 85766, 85823, 85824, 85779, 85802, 85821; 112WRD 295853089442100.

TABLE H-4-10 (CONTINUED)

MEASURES OF GENERAL WATER QUALITY - SOUTH AND EAST LAKE PONTCHARTRAIN BASIN

	IHNC 1/	GIWW at Paris Rd. 2/	MR-GO at Bayou Dupre 3/	MR-GO at mi.-5.0 (Breton Sound)	Lake Borgne 5/
Total Non-filterable Residue, mg/L					
Number of Observations	11	49	34	38	-
Mean	92	17	23	41	-
Range	27-188	0-94	0-100	3-593	-
Period of Record	3/75-7/79	4/77-7/82	1/76-1/81	4/75-1/81	-
Turbidity, JTU					
Number of Observations	11	100	30	32	652
Mean	74	8	10	5	35
Range	20-260	1-60	2-45	1-20	0-360
Period of Record	12/72-2/76	10/74-8/80	1/78-9/80	6/76-9/80	9/72-5/75
True Color, PT-CO units					
Number of Observations	11	116	34	36	651
Mean	43	14	14	6	35
Range	10-180	0-50	0-30	0-80	0-340
Period of Record	12/72-2/76	6/74-1/83	1/78-1/81	6/76-1/81	9/72-5/75
Nitrite plus Nitrate, ug/L-N					
Number of Observations	7	112	34	37	9
Mean	996	170	87	109	110
Range	80-1,600	0-880	0-550	0-960	10-460
Period of Record	11/75-7/79	10/74-1/83	1/78-1/81	2/76-1/81	4/75-5/75

TABLE H-4-10 (CONTINUED)

MEASURES OF GENERAL WATER QUALITY - SOUTH AND EAST LAKE PONTCHARTRAIN BASIN

	IHNC 1/	GIWW at Paris Rd. 2/	MR-GO at Bayou Dupre 3/	MR-GO at mi.-5.0 (Breton Sound)	Lake Borgne 5/
Total Organic Carbon, mg/L-C					
Number of Observations	13	114	29	33	174
Mean	5.1	7.1	6.9	4.2	6.5
Range	0.0-10.0	0.4-36.0	4.4-10.0	2.0-11.0	2.0-26.6
Period of Record	4/73-7/79	6/74-1/83	1/78-1/81	2/76-1/81	4/73-5/75
Chemical Oxygen Demand, (High Level) mg/L					
Number of Observations	17	45	34	36	-
Mean	34	215	215	337	-
Range	8-130	22-1,200	0-2,200	33-1,400	-
Period of Record	3/75-7/79	10/77-1/83	1/76-1/81	4/75-1/81	-
pH, field, standard units					
Number of Observations	903	120	34	36	2,132
Mean	7.5	7.6	7.7	8.2	7.9
Range	3.4-9.8	6.9-8.1	6.3-8.0	7.6-8.5	2.6-10.7
Period of Record	6/57-7/79	6/74-7/83	1/78-1/81	6/76-1/81	4/57-1/81
Total Alkalinity, mg/L as $CaCO_3$					
Number of Observations	15	120	34	36	653
Mean	90	67	67	103	69
Range	59-106	7-130	47-100	62-120	8-523
Period of Record	12/72-7/79	6/74-1/83	1/78-1/81	6/76-1/81	9/72-5/75

TABLE H-4-10

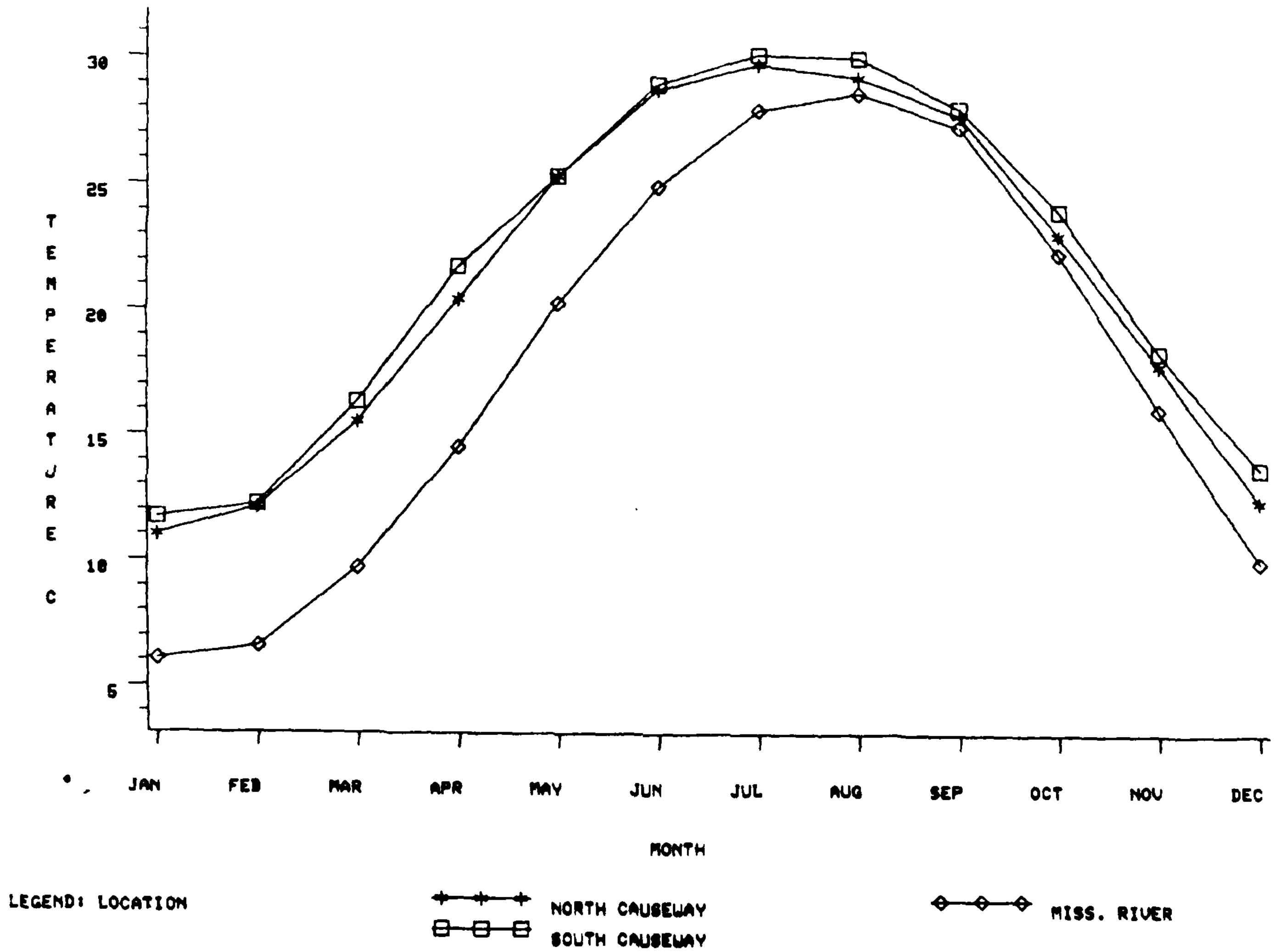
MEASURES OF GENERAL WATER QUALITY - SOUTH AND EAST LAKE PONTCHARTRAIN BASIN

	IHNC 1/	GIWW at Paris Rd. 2/	MR-GO at Bayou Dupre 3/	MR-GO at mi.-5.0 (Breton Sound)	Lake Borgne 5/
Water Temperature, °C					
Number of Observations	3502	48	-	-	2,278
Mean	20.3	21.4	-	-	20.7
Range	3.9-34.5	8.5-35.5	-	-	1.1-33.3
Period of Record	4/67-11/80	1/78-7/83	-	-	5/57-1/81
Dissolved Oxygen, mg/L					
Number of Observations	447	114	33	34	1,801
Mean	7.2	8.0	8.7	9.4	8.6
Range	0.3-13.4	3.6-11.8	5.9-11.6	7.1-12.0	0.3-14.9
Period of Record	8/67-5/75	6/75-1/83	1/78-1/81	6/76-1/81	11/68-1/81
Dissolved Oxygen Saturation, %					
Number of Observations	438	46	-	-	1,790
Mean	76.7	91.9	-	-	94.6
Range	4.0-128.7	66.7-121.0	-	-	3.8-128.7
Period of Record	8/67-5/75	7/75-7/83	-	-	11/68-1/81
5-Day Biochemical Oxygen Demand, mg/L					
Number of Observations	11	111	32	33	616
Mean	3.4	2.2	1.9	1.7	2.4
Range	1.1-10.6	0.0-8.5	0.1-9.0	0.0-4.6	0.1-17.7
Period of Record	12/72-2/76	6/74-1/83	1/78-1/81	6/76-1/81	9/72-5/75

FIGURE H-4-2

COMPARATIVE SURFACE WATER TEMPERATURES

MISSISSIPPI RIVER—WESTERN LAKE PONTCHARTRAIN



H.4.45. Mean salinities for the various sampling locations are generally indicative of the influences of fresh and saline water inflows to the lake. Most salinities were computed using total chloride concentrations. Sample means for salinity range from 0.3 ppt for the short-term sampling station near Kenner (station 1) to 5.8 ppt for the Chef Menteur Pass sampling station (station 9). Collectively, the salinity record for the 12 sampling stations ranges from near zero to 13.6 ppt and average 1.8 ppt overall.

H.4.46. Comparing the data of table H-4-8 for Lake Pontchartrain with data of table H-4-1 for the Mississippi River reveals disparity between mean levels of several general quality parameters for the two waterbodies. A graphical comparison of mean monthly surface water temperatures is presented as figure H-4-2. Generally, such a comparison indicates that, on average, waters of the Mississippi River are cooler, more turbid, and possess higher total alkalinity and suspended residue concentrations than the waters of Lake Pontchartrain. Further, generally higher nitrite plus nitrate and total phosphorus levels are evident in the river compared to the lake.

SOUTH AND EAST LAKE PONTCHARTRAIN BASIN

H.4.47. General quality statistics for major waterbodies located in the southern and eastern portions of the Lake Pontchartrain Basin are shown on table H-4-10. Statistical data, similar to that presented in table H-4-8 for Lake Pontchartrain, are provided for the Inner Harbor Navigation Canal (IHNC), the Gulf Intracoastal Waterway (GIWW) at New Orleans, the Mississippi River - Gulf Outlet (MR-GO), and the Lake Borgne Area. Statistics shown for the IHNC and Lake Borgne result from aggregated data for samples collected at several locations in those areas. Sampling agencies which provided water quality data for these locations are indicated in the footnotes of the table.

$mg/L-CaCO_3$ and averaged about 39 $mg/L-CaCO_3$. Sampling locations for which the lowest mean total akalinity was computed generally correspond to those having the lowest mean pH values.

H.4.43. In aggregate, measurements of total nonfilterable residue (suspended solids) at the various locations in Lake Pontchartrain range from about zero to 334 mg/L and average about 24 mg/L. The sample means for total nonfilterable residue range from about 17 mg/L for the temporary sampling station near Pointe Aux Herbes (station 10) to about 57 mg/L for the short-term station near Kenner (station 1). Sample means for turbidity measurements generally track, in absolute mangnitude, those for total nonfilterable residue. Sample means for turbidity range from 11 JTU for the sampling station near Bayou LaCombe (station 5) to 53 JTU for the short-termed sampling station near Kenner (station 1). Collectively, turbidity measurements average about 19 JTU and range from zero to 150 JTU. Aggregated data for true color measurements range from zero to 160 PT-CO (platinum-cobalt) units and average 28 PT-CO units. The distribution of true color sample means ranges from 16 PT-CO units for the sampling station located near the Inner Harbor Navigation Canal (station 11) to about 42 PT-CO units for stations near Pass Manchac and the Tchefuncta River (stations 2 and 4).

H.4.44. Observations of total nitrite plus nitrate concentrations in the lake range widely from zero to 2,500 ug/L and average about 316 ug/L-N overall. The distribution of sample means for the sum of nitrite and nitrate concentrations also show wide variation--ranging from about 80 ug/L-N for the Pass Rigolets sampling station to about 1,233 ug/L-N for the short-term sampling station near Kenner. Observations of total phosphorus concentrations in the lake average about 99 ug/L-P overall and range widely from 5 ug/L-P to 4,200 ug/L-P. The total phosphorus sample means also show singnificant variation ranging from 39 ug/L-P for the temporary sampling station near Pointe Aux Herbes to about 137 ug/L-P for the sampling station near the Tangipahoa River.

H.4.41. The total organic carbon measurements are more or less direct expressions of the instantaneous total organic chemical content of waters at the sampled locations. In aggregate, the measurements of total organic carbon range from 0.0 to 31 mg/L and average about 7.7 mg/L. The largest concentration of total organic carbon recorded, 31 mg/L, was also measured in a sample collected near the Inner Harbor Navigation Canal. This maximum value is about 11 percent greater than any of the other recorded maximum total organic carbon values. As shown in table H-4-8, sample means for total organic carbon range from 5.4 mg/L for the sampling station at Pass Rigolets (Station 7) to 9.1 mg/L for the sampling station near Pass Manchac (Station 2). The aggregated measurements of chemical oxygen demand range from 5 mg/L to 850 mg/L and average about 50 mg/L. The chemical oxygen demand sample means range from 23 mg/L for the short-term sampling station near Kenner (station 1) to 159 mg/L for the Chef Menteur Pass sampling station.

H.4.42. Examination of the data for pH revealed relatively infrequent instances of measured values below the 6.5 su minimum state standard. The highest percentage occurrence of low pH measurements was noted for sampling stations located near the Tangipahoa and Tchefuncta Rivers (stations 3 and 4). Approximately 11% and 9%, respectively, of the pH data for these sampling stations indicate observations less than the state standard. Additionally, about one percent of the pH record for sampling stations 6, 11, and 12; two percent for station 2; and about three percent for station 5 were less than the state standard. Collectively, observed pH values range from 5.7 su to 8.6 su and average about 7.4 su. Sample means for pH range from 7.1 su for sampling stations 2,3, and 4, to 7.7 su for stations 8,10, and 11. The distribution of total alkalinity sample means ranges from about 24 mg/L-$CaCO_3$ for sampling stations located near the Tangipahoa and Tchefuncta Rivers to about 65 mg/L-$CaCO_3$ for the temporary sampling station near Kenner. Overall, total alkalinity ranged from 3.0 mg/L-$CaCO_3$ to 326

TABLE H-4-12

MEASURES OF GENERAL WATER QUALITY - WEST MISSISSIPPI SOUND

	West Mississippi Sound [1/]
Water Temperature, °C	
Number of Observations	362
Mean	23.0
Range	7.3-32.5
Period of Record	8/72-12/77
Dissolved Oxygen, mg/L	
Number of Observations	310
Mean	8.7
Range	5.0-12.7
Period of Record	8/72-12/77
Dissolved Oxygen Saturation, %	
Number of Observations	308
Mean	100.9
Range	63.6-
Period of Record	8/72-12/77
5-Day Biochemical Oxygen demand, mg/L	
Number of Observations	60
Mean	1.9
Range	0.1-5.0
Period of Record	8/72-5/75
Total Organic Carbon, mg/L-C	
Number of Observations	41
Mean	7.6
Range	3.7-29.0
Period of Record	8/72-5/75
Chemical Oxygen Demand, (High Level) mg/L	
Number of Observations	-
Mean	-
Range	-
Period of Record	-

TABLE H-4-12 Continued

MEASURE OF GENERAL WATER QUALITY - WEST MISSISSIPPI SOUND

	West Mississippi Sound 1/
pH, field, standard units	
Number of Observations	354
Mean	7.9
Range	5.3-9.3
Period of Record	8/72-12/77
Total Alkalinity, mg/L as $CaCO_3$	
Number of Observations	55
Mean	55
Range	18-200
Period of Record	4/73-5/75
Total Non-filterable Residue, mg/L	
Number of Observations	9
Mean	47
Range	15-73
Period of Record	4/75-5/75
Turbidity, JTU	
Number of Observations	61
Mean	33
Range	0-150
Period of Record	8/72-5/75
True Color, PT-CO units	
Number of Observations	54
Mean	50
Range	0-160
Period of Record	4/73-5/75
Nitrite plus Nitrate, ug/L-N	
Number of Observations	15
Mean	88
Range	10-450
Period of Record	8/72-5/75

TABLE H-4-12 Continued

MEASURE OF GENERAL WATER QUALITY - WEST MISSISSIPPI SOUND

	West Mississippi Sound 1/
Total Phosphorus, ug/L-P	
Number of Observations	15
Mean	72
Range	10-450
Period of Record	8/72-5/75
Salinity, ppt 2/	
Number of Observations	75
Mean	3.4
Range	0.1-19.9
Period of Record	8/72-5/75

1/ West Mississippi Sound. Aggregate of data for four sampling locations - 1113S000 780238; 11COELMN: 05009, 05010; 112WRD 301120089251000.

2/ Salinity computed from chlorides.

[illegible] COASTAL RIVER BASIN

H.4.64. Descriptive water quality statistics for St. Louis Bay and the Back Bay of Biloxi are presented in table H-4-13. The statistics shown result from an aggregation of data generated by two agencies sampling the same locations, but over different periods. The agencies that provided water quality data for the listed locations are noted in the footnotes to the table.

H.4.65. The data suggest generally high mean dissolved oxygen concentrations particularly for the sampling location in the St. Louis Bay. The means of the 5-day biochemical oxygen demand, chemical oygen demand, and total phosphorus data are generally higher for all three sampling locations listed than corresponding values computed for Lake Pontchartrain. The mean nitrite plus nitrate values are generally lower than those computed for Lake Pontchartrain. The data suggest generally higher mean turbidity and total nonfilterable residue for the St. Louis Bay sampling location relative to values computed for Lake Pontchartrain. Generally, the mean values of other parameters listed for both the St. Louis Bay and Back Bay of Biloxi are similar to those computed for other brackish and saline waters of the study area.

PASCAGOULA AND ESCATAWPA RIVERS

H.4.66. General descriptive statistics for the Pascagoula and Escatawpa Rivers are shown in Table H-4-14. Summary data are presented for the West Pascagoula River and the Pascagoula River at US Highway 90. Additionally data characteristic of the reach of the Pascagoula River from mile 0 to, mile 13 (near Coll Town, MS) and the Escatawpa River from Moss Point to mile 5 are shown. The listed statistics result from an aggregation of data generate by two agencies as indicated in the footnotes to the table.

TABLE B-4-13

MEASURES OF GENERAL WATER QUALITY - SELECTED MISSISSIPPI COASTAL RIVER BASIN WATERS

	St. Louis Bay - Hwy 90 at Bay St. Louis, MS 1/	Back Bay of Biloxi near Biloxi, MS 2/	Back Bay of Biloxi at Ocean Springs, MS 3/
Water Temperature, °C			
Number of Observations	106	136	70
Mean	20.1	22.8	24.4
Range	1.0-31.0	1.5-32.5	6.5-30.5
Period of Record	2/74-3/83	6/73-3/83	6/73-6/77
Dissolved Oxygen, mg/L			
Number of Observations	105	133	69
Mean	9.1	7.5	7.2
Range	4.0-	0.4-13.2	3.2-13.5
Period of Record	2/74-3/83	6/73-3/83	6/73-6/77
Dissolved Oxygen Saturation, %			
Number of Observations	105	133	69
Mean	98.1	84.7	83.6
Range	42.6-	4.1-120.3	41.0-
Period of Record	2/74-3/83	6/73-3/83	6/73-6/77
5-Day Biochemical Oxygen Demand, mg/L			
Number of Observations	6	6	6
Mean	2.4	3.8	4.4
Range	0.9-3.8	1.6-8.3	2.3-8.2
Period of Record	10/75-7/77	10/75-6/77	10/75-6/77
Total Organic Carbon, mg/L-C			
Number of Observations	28	27	27
Mean	10.2	9.8	9.7
Range	4.1-18.0	4.0-15.5	4.0-20.0
Period of Record	9/74-11/82	9/74-11/82	9/74-6/77

TABLE H-4-13 (CONTINUED)

MEASURES OF GENERAL WATER QUALITY - SELECTED MISSISSIPPI COASTAL RIVER BASIN WATERS

	St. Louis Bay - Hwy 90 at Bay St. Louis, MS 1/	Back Bay of Biloxi near Biloxi, MS 2/	Back Bay of Biloxi at Ocean Springs, MS 3/
Chemical Oxygen Demand, mg/L			
Number of Observations	12	13	11
Mean	257	103	290
Range	5-940	3-300	32-67
Period of Record	9/74-12/77	9/74-3/83	9/74-8/76
pH, field, standard units			
Number of Observations	99	106	48
Mean	7.1	6.9	7.1
Range	5.9-8.0	4.5-8.2	5.5-8.3
Period of Record	1/75-3/83	9/74-3/83	9/74-6/77
Total Alkalinity, mg/L - $CaCO_3$			
Number of Observations	6	5	6
Mean	56	31	62
Range	22-90	13-53	31-76
Period of Record	10/74-7/77	10/74-8/76	10/74-6/77
Total Non-filterable Residue, mg/L			
Number of Observations	86	84	28
Mean	35	17	29
Range	0-268	1-85	6-151
Period of Record	10/74-3/83	10/74-3/83	10/74-6/77
Turbidity, JTU			
Number of Observations	33	32	32
Mean	43	12	10
Range	3-800	5-40	4-30
Period of Record	9/74-1/80	9/74-6/77	9/74-6/77

TABLE H-4-13 (CONTINUED)

MEASURES OF GENERAL WATER QUALITY - SELECTED MISSISSIPPI COASTAL RIVER BASIN WATERS

	St. Louis Bay - at Hwy 90 at Bay St. Louis, MS 1/	Back Bay of Biloxi near Biloxi, MS 2/	Back Bay of Biloxi at Ocean Springs, MS 3/
True Color, PT-CO units			
Number of Observations	38	38	28
Mean	24	34	27
Range	5-60	10-75	5-50
Period of Record	10/74-3/83	10/74-3/83	10/74-6/77
Nitrite plus Nitrate, ug/L-N			
Number of Observations	66	65	12
Mean	91	103	30
Range	0-1,370	0-1,930	10-100
Period of Record	9/74-3/83	9/74-3/83	9/74-6/77
Total Phosphorus, ug/L-P			
Number of Observations	66	66	36
Mean	124	187	127
Range	0-580	20-1,770	1-900
Period of Record	9/74-3/83	9/74-3/83	9/74-3/83
Salinity, ppt			
Number of Observations	55	54	5
Mean	12.1	11.7	13.7
Range	0.0-40.0	0.0-40.0	6.9-19.9
Period of Record	12/77-3/83	12/77-3/83	10/74-6/77

1/ St. Louis Bay - Hwy 90 to Bay St. Louis, MS (21MSWQ 02481675 8/75 to 3/83 112WRD 02481675 2/74 to 7/77)
2/ Back Bay of Biloxi near Biloxi, MS (21MSWQ 02481270 8/75 to 3/83, 112WRD 02481270 6/73 to 6/77)
3/ Back Bay of Biloxi at Ocean Springs, MS (21MSWQ 02481300 8/75 to 6/77, 112WRD 02481300 6/73 to 6/77)

TABLE H-4-14

MEASURES OF GENERAL WATER QUALITY - PASCAGOULA AND ESCATAWPA RIVERS

	West Pascagoula River Hwy 90 at Gautier, MS[1/]	Pascagoula River - Hwy 90 at Pascagoula, MS[2/]	Pascagoula River - Mile 0 to Mile 13[3/]	Escatawpa River - Moss Point to Mile 5[4/]
Water Temperature, °C				
Number of Observations	112	160	1,753	1,091
Mean	20.6	25.2	26.7	26.3
Range	2.8-30.0	7-31.0	7-31.5	3.0-36.0
Period of Record	9/72-3/83	9/72-7/82	9/75-8/72	10/69-3/83
Dissolved Oxygen, mg/L				
Number of Observations	112	159	1,752	1,092
Mean	7.3	5.5	4.4	3.0
Range	1.4-12.5	0.8-11.3	0.0-11.3	0.0-12.6
Period of Record	9/72-3/83	9/72-7/82	9/72-7/82	10/69-3/83
Dissolved Oxygen Saturation, %				
Number of Observations	111	159	1,752	1,086
Mean	76.7	65.1	54.0	35.2
Range	17.7-	10.3-136.7	0.0-	0.0-
Period of Record	9/72-3/83	9/72-7/82	9/72-7/82	10/69-3/83
5-Day Biochemical Oxygen Demand, mg/L				
Number of Observations	3	20	162	129
Mean	2.4	2.5	2.0	11.5
Range	0.4-4.5	0.5-5.5	0.2-7.2	0.4-162
Period of Record	9/72-9/76	9/72-7/82	9/72-7/82	11/69-7/82
Total Organic Carbon, mg/l-C				
Number of Observations	25	37	112	80
Mean	10.9	8.9	7.2	10.2
Range	5.8-22.0	2.8-18.5	2.8-18.5	4.2-28.0
Period of Record	9/74-11/82	9/74-7/82	9/74-7/82	8/72-11/82
Chemical Oxygen Demand, mg/L				
Number of Observations	17	11	-	39
Mean	41	176	-	46
Range	4-130	24-580	-	3-196
Period of Record	9/74-1/83	9/74-9/76	-	10/69-1/83
pH, field, standard units				
Number of Observations	89	128	1,298	694
Mean	6.6	7.2	7.2	6.6
Range	2.5-7.8	4.8-8.2	4.8-8.3	4.5-
Period of Record	9/74-3/83	9/74-7/82	4/59-7/82	10/69-3/83

TABLE H-4-14 CONTINUED

MEASURES OF GENERAL WATER QUALITY - PASCAGOULA AND ESCATAWPA RIVERS

	West Pascagoula River Hwy 90 at Gautier, MS[1/]	Pascagoula River - Hwy 90 at Pascagoula, MS[2/]	Pascagoula River - Mile 0 to Mile 13[3/]	Escatawpa River - Moss Point to Mile 5[4/]
Total Alkalinity, mg/L - $CaCO_3$				
Number of Observations	5	8	-	32
Mean	16	49	-	19
Range	8-34	11-87	-	2-69
Period of Record	10/74-9/76	10/74-5/79	-	10/69-5/79
Total Dissolved Solids, mg/L				
Number of Observations	12	16	-	35
Mean	2,968	8,399	-	3,990
Range	46-19,290	154-21,600	-	56-19,000
Period of Record	9/74-9/76	9/74-7/82	-	5/70-7/82
Total Chloride, mg/L				
Number of Observations	4	10	-	22
Mean	997	6,644	-	4,893
Range	20-3,400	62-13,000	-	30-54,000
Period of Record	10/74-10/75	10/74-7/82	-	9/71-7/82
Total Sulfate, mg/L				
Number of Observations	3	9	-	33
Mean	204	844	-	304
Range	7-570	12-1,700	-	9-1,400
Period of Record	10/74-4/75	10/74-7/82	-	10/69-7/82
Total Non-filterable Residue, mg/L				
Number of Observations	82	32	96	127
Mean	13	21	38	16
Range	1-50	0-69	0-460	1-122
Period of Record	10/74-3/83	10/74-7/82	10/74-7/82	10/69-3/83
Turbidity, JTU				
Number of Observations	32	32	-	43
Mean	17	14	-	12
Range	5-50	2-65	-	4-85
Period of Record	9/74-6/77	9/74-6/77	-	11/71-6/79
True Color, PT-CO units				
Number of Observations	38	32	55	77
Mean	39	40	36	64
Range	7-85	10-100	7-100	10-150
Period of Record	10/74-3/83	10/74-7/82	4/59-7/82	10/69-3/83

TABLE H-4-14 CONTINUED

MEASURES OF GENERAL WATER QUALITY - PASCAGOULA AND ESCATAWPA RIVERS

	West Pascagoula River Hwy 90 at Gautier, MS1/	Pascagoula River - Hwy 90 at Pascagoula, MS2/	Pascagoula River - Mile 0 to Mile 13 3/	Escatawpa River - Moss Point to Mile 5 4/
Nitrite plus Nitrate, ug/L-N				
Number of Observations	63	24	120	125
Mean	166	80	94	124
Range	10-2,190	10-170	10-290	10-634
Period of Record	9/74-3/83	10/74-5/79	9/74-7/82	9/74-3/83
Total Phosphorus, ug/L-P				
Number of Observations	63	26	137	155
Mean	127	70	71	127
Range	10-930	20-160	20-230	0-3,210
Period of Record	9/74-3/83	9/72-7/82	9/72-7/82	11/7-3/83

1/ West Pascagoula River - Hwy 90 at Gautier, Mississippi (21MSWQ 02480285, 8/75 to 3/83; 112WRD 02480285, 9/72 to 9/75)

2/ Pascagoula River - Hwy 90 at Pascagoula, Mississippi (21MSWQ 02480210, 8/75 to 6/77; 112WRD 02480210, 9/72 to 7/82)

3/ Pascagoula River - Mile 0 to Mile 13. Aggregate of data for 15 sampling locations - 21MSWQ: 02480210; 112WRD: 02480215, 02480212, 02480210, 302319088335400, .02345088343800, 302430088350400, 302507088342800, 302507088342800, 302526088333600, 02479343, 302648088340600, 302725088333700, 302822088332500, 02479342, 02479341.

4/ Escatawpa River - Moss Point to Mile 5. Aggregate of data for 7 sampling locations - 21MSWQ: 02480207; 112WRD 02480207, 02480208, 302459088320800, 302455088313100, 302528088304400, 302515088301300.

H.4.67. As shown, data for the West Pascagoula River at US Highway 90 had the highest computed mean for dissolved oxygen concentrations, 7.3 mg/L. About 21% of the DO record indicated concentrations less than 5.0 mg/L. The mean of the dissolved oxygen record for the Pascagoula River at Highway 90 is substantially lower at 5.5 mg/L. About 41% of the record of dissolved oxygen measurements are less than 5.0 mg/L. Data for the Pascagoula Rver from mile 0 to mile 13, inclusive of the data for the Pascagoula River at Highway 90, indicate a mean dissolved oxygen concentration of only 4.4 mg/L. About 51% of the aggregated record of dissolved oxygen observations indicate concentrations below 5.0 mg/L, about 31% show concentrations less than 3.0 mg/L, and about 14% show concentrations less than 1.9 mg/L. The mean dissolved oxygen computed for the reach of the Escatawpa river from Moss Point to mile 5 is only 3.0 mg/L. About 72% of the aggregated records of dissolved oxygen measurements show concentrations below 5.0 mg/L, about 30% of these data are less than 3.0 mg/L, and about 35% are below 12.0 mg/L.

H.4.68. Sample means for the pH data are about 7.2 su for the Pascagoula River and about 6.6 su for the West Pascagoula and Escatawpa Rivers. About 10% of the pH record for the Pascagoula River, mile 0 to mile 13, shown values below 6.5 su.

About 40% of the pH record for the West Pascagoula River at Highway 90 and about 37% of the record for the Escatawpa River, Moss Point to mile 5, indicate values less than 6.5 su.

H.4.69. The mean values of chemical oxygen demand, total dissolved solids, total chlorides, and total sulfate are much higher for the Pascagoula River values computed for the West Pascagoula and Escatawpa Rivers. Conversely, observed nitrite plus nitrate and total phosphorus concentrations and, on average, substantially lower for the Pascagoula River compared to the West Pascagoula and Escatawpa Rivers.

Section 5. EXISTING BACTERIOLOGICAL QUALITY

H.5.1. The direct search for a specific pathogen in water is uneconomical, slow, and unwieldy for routine control purposes. Instead, water is examined for an indication of fecal contamination, and when such indication is found, it is assumed that the water is potentially dangerous. The presence of coliform organisms in a water sample is regarded as evidence of such pollution and has served for many years as a basis for water quality criteria. The coliform group of organisms includes, by definition, "all aerobic and facultative anaerobic, Gram-negative, nonspore-forming, rod-shaped bacteria that ferment lactose (milk sugar) with gas formation within 48 hours at 35°C." Bacteria of this group have been associated with both the feces of warm-blooded animals and with soil. The fecal coliform bacteria, which make up a portion of the total coliform group, are determined by an elevated temperature test -- being able to grow at 44.5°C and ferment lactose, which produces acid and gas. Using fecal coliform bacteria has proven to be of more sanitary significance than using total coliform bacteria, because fecal coliforms originate in the intestinal tract of warm-blooded animals. The presence of bacterial, viral, protozoan, and possibly fungal species that are pathogens, and possess the potential to infect man and other organisms, is ndirectly indicated by the presence of the fecal coliform group of bacteria. Thus, the number of fecal coliforms present indicates the degree of health risk associated with using water for drinking, swimming, or shellfish harvesting. Bacteriological water quality standards applicable to the study area are shown in table H-5-1.

MISSISSIPPI RIVER

H.5.2. The sanitary quality of the proposed diversion source water, as characterized by the observed densities of the fecal coliform indicator organism, is presented in tables H-5-2 and H-5-3.

TABLE H-5-1

BACTERIOLOGICAL WATER QUALITY STANDARDS APPLICABLE TO THE STUDY AREA

Primary Contact Recreation - Based on a minimum of not less than five samples taken over not more than a 30-day period, the fecal coliform content shall not exceed a log mean of 200/100 mL nor shall more than 10 percent of the total samples during any 30-day period exceed 400/100 mL.

Secondary Contact Recreation - Based on a minimum of not less than five samples taken over not more than a 30-day period, the fecal coliform content shall not exceed a log mean of 1,000/100 mL nor shall more than 10 percent of the total samples during any 30-day period equal or exceed 2,000/mL.

Shellfish Harvesting Waters - The median fecal coliform bacteria concentration should not exceed 14 MPN (most probable number) 100 mL with not more than 10 percent of the samples exceeding 43 MPN/100 mL for the taking of shellfish.

Fish and Wildlife (Mississippi) - The fecal coliform content shall not exceed a geometric mean of 2,000/100 mL, nor shall more than ten percent of the samples examined during any month exceed 4,000/100 mL.

TABLE H-5-2

Observed Fecal Coliform Bacteria Densities* - Mississippi River

	Sampling Station Number**									Nine Station
	1	2	3	4	5	6	7	8	9	Aggregate
Number of Observations	156	49	50	46	49	145	69	143	51	758
Mean (logarithmic)	455	477	593	428	421	326	225	1,095	1,056	506
Range	5-8,800	70-3,500	80-5,400	20-5,400	20-3,300	5-10,000	5-3,000	20-54,000	60-17,000	5-54,000
Period of Record	1/73-1/83	5/78-5/83	5/78-5/83	4/78-5/83	4/78-5/83	1/73-1/83	2/73-1/83	1/73-9/78	10/77-12/82	1/73-5/83
Weighted Percentiles										
5	77	85	121	91	55	50	5	200	176	80
10	127	130	176	124	110	100	68	264	270	130
20	224	170	330	220	170	150	120	358	400	210
30	300	330	330	270	220	200	160	480	506	300
40	350	330	472	330	310	274	200	860	792	350
50 (median)	425	490	490	460	490	350	270	1,200	1,100	480
60	572	790	790	490	490	456	320	1,740	1,220	700
80	1,000	1,100	1,300	1,100	1,300	758	500	3,100	2,910	1,300
90	1,500	1,300	1,700	1,330	2,300	1,140	1,100	4,680	3,740	2,400
95	2,415	2,400	3,750	1,700	2,600	1,680	1,450	7,640	10,040	3,500

* Number of colonies per 100 ml.
** Sampling Stations -

1: Mississippi River at Union, Louisiana (112WRD 07374220). Located approximately at river mile 168 A[illegible]ad of Passes (AHP).

2: Mississippi River - East Bank at Lutcher, Louisiana (21LA1ORS B070345050). Located approximately at river mile 148 AHP.

3: Mississippi River - West Bank at Lutcher, Louisiana (21LA1ORS S070345060). Located approximately at river mile 148 AHP.

4: Mississippi River - East Bank at Luling, Louisiana (21LA1ORS S070345070). Located approximately at river mile 120 AHP.

5: Mississippi River - West Bank at Luling, Louisiana (21LA1ORS S070345080). Located approximately at river mile 120 AHP.

6: Mississippi River at Luling Ferry, Louisiana (112WRD 07374400). Located approximately at river mile 120 AHP.

7: Mississippi River at New Orleans, Louisiana (112WRD 07374508). Located approximately at river mile 104 AHP.

8: Mississippi River at Violet, Louisiana (112WRD 07374522). Location was approximately at river mile 83 AHP.

9: Mississippi River at Belle Chasse, Louisiana (112WRD 07374525). Located approximately at river mile 76 AHP.

AD-A152 725 MISSISSIPPI AND LOUISIANA ESTUARINE AREAS FRESHWATER DIVERSION TO LAKE PO..(U) ARMY ENGINEER DISTRICT NEW ORLEANS LA D L CHEW APR 84 4/6

UNCLASSIFIED F/G 13/2 NL

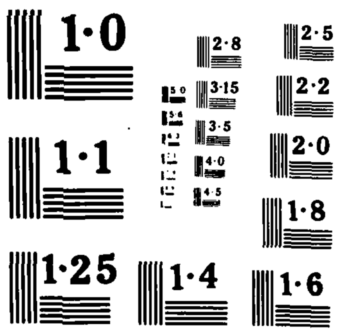

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Table H-5-3

Seasonal Fecal Coliform Bacteria Densities*-Mississippi River

	MONTH											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Number of observations**	[illegible]	[illegible]	62	68	69	66	61	57	50	54	63	55
[illegible]	466	[illegible]	54[illegible]	49[illegible]	490	471	697	495	521	538	645	455
Range	[illegible]	[illegible]	[illegible]-3,[illegible]	[illegible]-9,600	20-4,400	60-9,500	5-10,000	20-17,000	10-14,000	40-17,000	20-54,000	5-[illegible],200
Selected percentiles												
[illegible]	[illegible]	[illegible]	9[illegible]	135	80	111	18	45	18	97	110	5
[illegible]	[illegible]	[illegible]	113	159	12[illegible]	164	182	60	82	125	130	200
[illegible]	[illegible]	[illegible]	22[illegible]	21[illegible]	23[illegible]	230	340	136	200	180	198	330
[illegible]	[illegible]	[illegible]	3[illegible]	28[illegible]	28[illegible]	273	456	220	300	255	284	40[illegible]
[illegible]	[illegible]	[illegible]	[illegible]92	32[illegible]	[illegible]	338	488	356	400	330	330	490
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	455	790	460	595	430	650	700
[illegible]	[illegible]	[illegible]	79[illegible]	[illegible]78	[illegible]	492	1,020	740	790	700	1,000	840
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	944	2,240	1,840	1,780	1,500	2,200	2,[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible],280	[illegible]	1,630	5,160	3,340	2,760	3,150	2,960	3,000
[illegible]	[illegible]	[illegible]	3,[illegible]	[illegible]	2,[illegible]	2,390	6,140	5,740	6,285	5,600	6,460	4,000

* [illegible]

** [illegible] sampling locations:

[illegible] Louisiana (112WRD 0737[illegible]) [illegible] to 3/83. Located approximately at river mile 168 Above Head of Passes (AHP).

[illegible] East Bank at [illegible], Louisiana (21[illegible] B070345050) 1/78 to 5/83. Located approximately at river mile 148 AHP.

[illegible], Louisiana (21LA[illegible]S S070345060) 1/78 to 5/83. Located approximately at river mile 148 AHP.

[illegible], Louisiana (21LA[illegible]RS S070345070) 1/78 to 5/83. Located approximately at river mile 120 AHP.

[illegible], Louisiana (21LA[illegible]RS S070345080) 1/78 to 5/83. Located approximately at river mile 120 AHP.

[illegible], Louisiana (112WR[illegible]) 10/57-3/83. Located approximately at river mile 120 AHP.

[illegible], Louisiana (112WRD 0737[illegible]) 2/53-1/83. Located approximately at river mile 104 AHP.

[illegible] (112WRD 07374522) [illegible]73-9/78. Location was approximately at river mile 93 AHP.

[illegible] River at [illegible], Louisiana (112WRD 07374525) 8/76-1/83. Located approximately at river mile 76 AHP.

H.5.3. It should be noted that the bacteriological data in table H-5-2 and table H-5-3 are not directly comparable to the bacterial standards listed in table H-5-1. Available data were derived from grab samples collected at frequencies seldom exceeding semimonthly. Many of these data were also expressed as membrane filter counts as opposed to the MPN (most probable number) of organisms present. Still, these data are useful for analysis of the water's sanitary quality. On an annual basis and for the aggregate data shown on table H-5-2, the logarithmic mean of the observed fecal coliform densities is 506/100 milliliters. The mean is well below the value of 1,000/100 mL secondary contact recreational standard. However, the observed fecal coliform density that was equalled or exceeded 10 percent of the time, 2,400/100 mL, is above the corresponding 2,000/100 mL standard. As can be noted by examining table H-5-2, the highest fecal coliform densities that have been measured in the study reach have generally occurred downstream of New Orleans.

MAJOR TRIBUTARIES TO LAKE PONTCHARTRAIN

H.5.4. The sanitary quality of selected west and northern tributaries to Lake Pontchartrain, as characterized by measured fecal coliform bacteria densities, is shown in table H-5-4. Summary statistics of observed fecal coliform densities are presented for Lake Maurepas (station 1), Pass Manchac (station 2), and Tangipahoa (stations 3 and 4) and Tchefuncta (stations 5 and 6) river locations. These water bodies are classified by the State of Louisiana as suitable for primary contact recreational activities. As was indicated previously, the observed densities of table H-5-4 are not directly comparable to the state standard, primarily because of the standard's conditon relative to sampling frequency. However, for this data presentation, it is assumed that the bulk of the listed data are representative of distributions of bacteria densities which would be observed under more frequent sampling. It should also be noted that relatively high minimum

TABLE H-5-4

Observed Fecal Coliform Bacteria Densities*-Selected Tributaries to Lake Pontchartrain

	Sampling Station Number**					
	1	2	3	4	5	6
Number of Observations	133	55	54	108	98	52
Mean (logarithmic)	5	34	169	295	277	119
Range	1-1,400	20-790	20-24,000	4-240,000	4-25,000	20-9,200
Period of Record	4/75-1/81	3/78-12/82	3/78-12/82	11/72-1/83	3/74-1/83	5/78-12/82
Weighted Percentiles						
5	1	20	20	20	39	20
10	2	20	20	20	59	20
20	2	20	40	49	80	20
30	4	20	60	80	110	38
40	4	20	80	130	136	72
50 (median)	5	20	130	190	200	95
60	5	20	140	330	312	130
80	5	50	790	1,800	1,040	394
90	17	170	2,850	13,100	2,450	1,700
95	27	532	5,400	24,000	5,400	4,165

* Number of colonies per 100 ml.

** Sampling Locations-

1: Middle of Lake Maurepas near Manchac, Louisiana (112WRD 301500090300000). About one-third of the data (about 50 samples) were accumulated during the period April 16, 1979 to June 14, 1979

2: Pass Manchac, East of US Highway 51 (21LA1ORS B041705010).

3: Tangipahoa River at Highway 38 Bridge (21LA1ORS B042180010).

4: Tangipahoa River at US Highway 190 Bridge (21LA1ORS B042180030, 112WRD 0737500, 10/43-1/83)

5: Tchefuncta River at US Highway 190 Bridge (21LA1ORS S042200010, 112WRD 07375050, 10/43-1/83).

6: Tchefuncta River at Highway 22 Bridge (21LA1ORS S042200020).

detection limits were used for some bacteria analyses (note particularly the percentiles for the Pass Manchac sampling location). Thus, the mean values computed for those data are larger than the true mean values.

H.5.6. The logarithmic means of the bacteria data range from about 5 colonies per 100 milliliters (mL) for the Lake Maurepas sampling location to about 295 colonies/100 mL for the Tangipahoa River at US Highway 190. The data for both the Tangipahoa River and the Tchefuncta River at US Highway 190 suggest that the primary contact recreational standard might have been contravened frequently for those locations. Both of the logarithmic means and 90th percentile values for those locations exceed the values cited in the state standard. About 45% of the fecal coliform bacteria data for the Tangipahoa River at US Highway 190 are greater than 200 colonies/100 mL and about 33% are greater than 400 colonies/100 mL. For the Tchefuncta River at US Highway 190, approximately 51% of the data exceed 200 colonies/100 mL and about 37% exceed 400 colonies/100 mL. The data for the Tangipahoa River at Highway 38 and the Tchefuncta River at Highway 22 also indicate that the primary contact recreational standard might have been exceeded, but less frequently, at those locations. The log-mean values for these sampling locations are less than the 200 colonies/100 mL cited in the state standard. However, the 90th percentile densities are considerably greater than the 400 colonies/100 mL cited in the state standard. For the Tangipahoa River at Higway 38, about 35% of the fecal coliform data are greater than 200 colonies/100 mL and approximately 20% greater than 400 colonies/100 mL. Similarly, about 31% of the data for the Tchefuncta River at Highway 22 are greater than 200 colonies/100 mL and approximately 17% exceed 400 colonies/100 mL. The fecal coliform bacteria data for Lake Maurepas and Pass Manchac imply no contraventions of the state standards for those sampling locations.

LAKE PONTCHARTRAIN

H.5.7. Recorded fecal coliform bacteria densities for twelve Lake Pontchartrain sampling locations are presented in table H-5-5. The primary contact recreation standard is applicable for areas in the lake to the west of Highway 11 bridge. Areas located to the east of the Highway 11 bridge (sampling stations 6 through 10 on the table) are classified as suitable for harvesting shellfish.

H.5.8. Observed log-mean densities range from 3 colonies/100 mL for the short-termed sampling station north of Pointe Aux Herbes (station 10) to about 35 colonies/100 mL for the Pass Rigolets sampling location (station 7). The log-mean and the 90th percentile values for all of the sampling locations listed are well below the values cited in the primary contact recreational standard. The fecal coliform data for the Pass Rigolets and Chef Menteur Pass sampling locations suggest contraventions of the shellish harvesting standard. However, no conclusion can be drawn since the percentiles of the observations indicate that the minimum detection limit of the bacteria analyses was 20 colonies/100 mL. This value is higher than the 14 colonies/100 mL median value cited in the state standard.

H.5.9. Additional observed fecal coliform data, for sampling locations along the south shore of Lake Pontchartrain, are presented in table H-5-6. Generally, these data indicate severe bacterial pollution at various locations in the lake in the vicinity of major drainage canals from the New Orleans Metropolitan Area.

H.5.10. A 1982 bacterial pollution study of the lake was conducted by the Louisiana Department of Health and Human Resources, Office of Health Services and Environmental Quality. The study concluded that primary contact recreational activities were not advisable within one-quarter

TABLE H-5-5

Observed Fecal Coliform Bacteria Densities*-Lake Pontchartrain

	Sampling Station Number**											
	1	2	3	4	5	6	7	8	9	10	11	12
Number of Observations	50	167	158	155	155	69	46	68	45	49	154	151
Mean (logarithmic)	8	14	21	21	14	4	35	6	32	3	30	5
Range	1-[illegible]	1-3,[illegible]	1-3,600	1-3,400	1-2,500	1-100	20-1,300	1-160	20-1,100	1-120	1-12,000	1-1,400
Period of Record	4/79-6/79	6/74-1/83	6/74-1/81	6/74-1/81	6/74-1/81	4/79-1/81	4/78-12/82	4/79-1/81	4/78-12/82	4/79-6/79	6/74-1/81	6/74-1/81
Weighted Percentiles												
5	2	2	2	2	2	2	20	2	20	1	2	1
10	2	2	2	2	2	2	20	2	20	2	5	2
20	2	5	4	4	2	2	20	2	20	2	5	2
30	3	6	5	5	4	2	20	3	20	2	12	4
40	4	8	8	10	5	2	20	4	20	2	18	4
50 (median)	4	13	16	16	10	4	20	4	20	4	24	5
60	8	20	40	36	18	4	20	6	20	4	40	5
80	58	37	140	89	67	8	76	15	50	4	110	8
90	118	82	333	336	190	14	188	20	140	8	255	20
95	130	110	595	616	286	27	309	30	700	28	615	45

* Number of colonies per 100 ml.

** Sampling Locations-

Number

1: Lake Pontchartrain 9.8 miles NNW of Kenner, LA (112WRD 300922090171500) 4/79-6/79. Temporary sampling station for water quality monitoring during 1979 diversion of flood flows through the Bonnet Carre' Floodway.

2: Lake Pontchartrain at Pass Manchac, near Manchac LA (112WRD 301730090180000) 6/74-1/83. Approximately one-third of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows throuh the Bonnet Carre' Floodway.

3: Lake Pontchartrain at Mouth of Tangipahoa River, near Lee Landing (112WRD 301945090161500) 6/74-1/81. Approximately one-third of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

4: Lake Pontchartrain at Mouth of Tchefuncta River, near Madisonville, LA (112WRD 302150090102000) 6/74-1/81. Approximately one-third of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

5: Lake Pontchartrain at Mouth of Bayou LaCombe, near LaCombe, LA (112WRD 301500089572000) 6/74-1/81. Approximately one-third of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

6: Lake Pontchartrain at West Rigolets, 5.7 miles SSE of Slidell, LA (112WRD 301015089451500) 4/79-1/81. Approximately 70 percent of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

7: Pass Rigolets at US Highway 90 Bridge (21LA1ORS B041708010) 3/78-4/83.

8: Lake Pontchartrain 2.2 miles NNW of Chef Menteur, LA (112WRD 300555089490300) 4/79-1/81. Approximately 70 percent of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

9: Chef Menteur Pass at US Highway 90 Bridge (21LA1ORS S040615010) 3/78-4/83.

10: Lake Pontchartrain 0.9 miles North of Pointe Aux Herbes, LA (112WRD 301000089510000) 4/79-6/79. Temporary sampling station for water quality monitoring during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

11: Lake Pontchartrain at Inner Harbor Navigation Canal (112WRD 300205090015500) 6/74-1/81. Approximately one-third of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' floodway.

12: Lake Pontchartrain at Mid Causeway (112WRD 301116090073300) 6/74-1/81. Approximately one-third of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

Table H-5-6

Observed Fecal Coliform Bacteria Densities*-South Shore of Lake Pontchartrain

	Sampling Locations**										
	1	2	3	4	5	6	7	8	9	10	11
Number of observations	26	20	27	26	74	28	50	67	25	24	13
Logarithmic mean	[illegible]	336	627	1,480	219	342	172	261	726	617	88
Arithmetic mean	[illegible]	1,945	1,745	26,588	878	22,929	828	1,209	7,808	3,510	129
Range	[illegible]	20-16,000	40-17,[illegible]	20-350,000	20-7,900	20-350,000	20-9,200	20-16,000	20-160,000	20-35,000	20-330
Period of Record	5/77-3/81	5/77-3/81	5/77-12/80	5/77-3/81	8/75-3/81	5/77-12/80	7/76-12/80	7/76-10/80	5/77-3/81	5/77-12/80	3/76-9/80
Weighted Percentiles											
5	74	22	75	27	20	20	20	20	20	20	20
10	367	50	130	61	20	20	20	20	20	20	24
20	2,300	54	216	146	50	20	20	46	100	110	30
30	3,300	80	318	220	75	71	43	74	426	175	34
40	3,300	94	330	458	130	98	84	114	574	330	50
50	4,100	140	460	1,200	170	135	170	310	1,100	330	130
60	7,000	552	772	2,220	230	264	226	490	1,540	2,300	170
80	25,600	3,200	1,940	15,400	1,300	3,620	772	1,300	3,120	4,900	230
90	145,[illegible]	7,570	6,160	109,800	3,400	45,600	2,380	3,340	4,900	9,000	290
95	414,000	15,595	13,880	311,500	4,900	300,500	6,065	7,680	113,470	29,000	330

* Number of colonies/100 ml.

** Locations:

1: Lake Pontchartrain at 17th Street Canal, New Orleans, Louisiana (21LALDHM 04124102).

2: Lake Pontchartrain at Canal Boulevard, New Orleans, Louisiana (21LALDHM 04124103).

3: Lake Pontchartrain at mouth of New Orleans Yacht Harbor (21LALDHM 04124101).

4: Lake Pontchartrain at Orleans Canal, New Orleans, Louisiana (21LALDHM 04124104).

5: Lake Pontchartrain at Bayou Saint John, New Orleans, Louisiana (21LALDHM 04124105).

6: Lake Pontchartrain at London Avenue Canal, New Orleans, Louisiana (21LALDHM 04124106).

7: Lake Pontchartrain at Pontchartrain Beach, New Orleans, Louisiana (21LALDHM 04124107).

8: Lake Pontchartrain at Seabrook Bridge, New Orleans, Louisiana (21LALDHM 04124108).

9: Lake Pontchartrain at Citrus Canal, New Orleans, Louisiana (21LALDHM 04114201).

10: Lake Pontchartrain at Paris Road (Little Woods), New Orleans, Louisiana (21LALDHM 04114202).

11: Lake Pontchartrain at Interstate Highway 10 Bridge (21LALDHM 04104305).

mile of the south shore within Jefferson and Orleans Parishes. Primary contact activities are also discouraged along the north shore within a 200 yard radius of the mouth of streams which flow into the lake.

SOUTH AND EAST LAKE PONTCHARTRAIN BASIN

H.5.11. Summary statistics indicative of the sanitary quality of major water bodies located in the south and east Lake Pontchartrain basin are presented in table H-5-7. Summary data are shown for the IHNC, the GIWW, the MR-GO, and the Lake Borgne area. The primary contact recreation standard is applicable for the the IHNC; the GIWW, MR-GO, and the Lake Borgne areas are classified as suitable for shellfish harvesting.

H.5.12. The fecal coliform data for the IHNC suggest frequent contraventions of the primary contact recreational standard. The log-mean of the IHNC data is 4,160 colonies/100 mL and 90th percentile value is 55,000 colonies/100 mL. These values are well above the 200 colonies/100 mL and 400 colonies/mL cited in the state standard. About 94% of the fecal coliform data for the IHNC sample are greater than 200 colonies/100 mL and approximately 87% are greater than 400 colonies/100 mL.

H.5.13. Frequent contraventions of the shellfish harvesting standard are inferred by the fecal coliform data for the GIWW sampling location. The median of the data for the GIWW is 47 colonies/100 mL and the 90th percentile values is 320 colonies/100 mL. These values are well above the 14 colonies/100 mL and 43 colonies/100 mL cited in the state standard. Approximately 75% of the fecal coliform data for the GIWW sampling location exceed 14 colonies/100 mL and about 51% exceed 43 colonies/100 mL.

TABLE H-5-7

Observed Fecal Coliform Bacteria Densities* - South and East Lake Pontchartrain Basin

	IHNC 1/	GIWW near Paris Rd 2/	MRGO at Bayou Dupre 3/	MRGO at mi. -5.0 (Breton Sound) 4/	Lake Borgne 5/
Number of Observations	47	109	34	35	802
Mean (logarithmic)	4,160	44	14	4	10
Range	70-240,000	1-2,000	2-300	2-120	1-4,200
Period of Record	12/72-2/81	6/74-1/83	1/78-1/81	6/76-1/81	9/72-1/81
Weighted Percentiles					
5	97	5	2	2	0
10	362	5	2	2	0
20	1,000	12	2	2	2
30	1,420	20	5	2	4
40	2,400	30	5	4	6
50 (median)	3,500	47	14	5	10
60	7,900	80	24	5	15
80	19,000	150	70	5	40
90	55,000	320	143	14	90
95	154,000	550	210	37	189

* Number of colonies per 100 mL.

1/ Inner Harbor Navigation Canal. Aggregate of data for four sampling locations - 21LALDHM: 04124202, 04124205; 11COELMN 76160; 112WRD 295730090013900.

2/ Gulf Intracoastal Waterway near Paris Rd at New Orleans, LA (112WRD 300024089560500)

3/ Mississippi River Gulf Outlet at Bayou Dupre (112WRD 295630089501800)

4/ Mississippi River Gulf Outlet at mile -5.0, -Breton Sound (112WRD 292730089032200)

5/ Lake Borgne. Aggregate of data for 19 sampling locations - 21LALDHM: 04134401, 04124403, 04134503; 11COELMN 86201, 86002, 86202, 86001, 85769, 86102, 85828, 85768, 85826, 85778,86101, 85766, 85802, 85821; 112WRD 295853089442100.

H.5.14. Fecal coliform data for the MR-GO at Bayou Dupre and Lake Borgne area imply occasional contraventions of the shellfish harvesting standard. The median of the MR-GO data is 14 colonies/100 mL; the 90th perceantile value is 143 colonies/100 mL. About 47 percent of the fecal coliform data for the MRGO exceed 14 colonies/100 mL and about 18 percent exceed 43 colonies/100 mL. The median of the fecal coliform data for the Lake Borgne area is 10 colonies/100 mL and the 90th percentile value is 90 colonies/100 mL. Approximate 40 percent of these data are greater than 14 colonies/100 mL and about 18 percent are greater than 43 colonies/100 mL. The fecal coliform data for the MR-GO at Breton Sound suggest no contraventions of the shellfish standard for that location.

PEARL RIVER

H.5.15. Summary statistics for fecal coliform bacteria densities observed at two Pearl River sampling locations are shown in table H-5-8. Comparing these statistics to the primary contact recreational standard implies possible occasional contravention for both sampling locations. The log-mean of the data are 77 colonies/100 mL for the West Pearl River sampling location and 89 colonies/100 mL for the East Pearl River location. Both of these values are well below the 200 colonies/100 mL standard. However, the 90th percentile values are about 490 colonies/100 mL-slightly greater than the 400 colonies/100 mL cited in the standard. Approximately 16% of the fecal coliform data for the West Pearl River sampling location, exceed 200 colonies/100 mL and about 14% exceed 400 colonies/100 mL. Similarly, for the East Pearl River sampling location about 22% of the fecal coliform data are greater than 200 colonies/100 mL and about 12% are greater than 400 colonies/100 mL.

Table H-5-8

Observed Fecal Coliform Bacteria Densities*-Pearl River

	West Pearl River at Highway 90 Bridge1/	East Pearl River at Highway 90 Bridge2/
Number of Observations	50	50
Mean (logarithmic)	77	89
Range	20-2,400	20-3,500
Period of Record	3/78-5/83	3/78-5/83
Weighted Percentiles		
5	20	20
10	20	20
20	20	20
30	40	50
40	50	70
50 (median)	70	80
60	80	110
80	130	226
90	490	489
95	930	970

* Number of colonies per 100 ml.

1/ West Pearl River at Highway 90 Bridge (21LA10RS S090465020).

2/ East Pearl River at Highway 90 Bridge (21LA10RS B090465010).

WEST MISSISSIPPI SOUND

H.5.16. Aggregate summary statistics of measured fecal coliform densities at four locations in the West Mississippi Sound are presented in table H-5-9. Comparing these statistics to the shellfish harvesting standard suggest possible occasional contraventions. The median of the data is 9 colonies/100 mL--well below the 14 colonies/100 mL value cited in the standard. However, the 90th percentile value, 74 colonies/100 mL, is well above the 43 colonies/100 mL cited in the shellfish harvesting standard. Approximately 32% of the aggregated fecal coliform data are greater than 14 colonies/100 mL and about 17 percent of the data are greater than 43 colonies/100 mL.

SELECTED MISSISSIPPI COASTAL RIVER BASIN WATERS

5.17. Distributions of observed fecal coliform bacteria densities for sampling locations in St. Louis Bay and the Back Bay of Biloxi are shown in table H-5-10. The percentiles for the St. Louis Bay at Highway 90 and the Back Bay of Biloxi near Biloxi, Mississippi imply possible contraventions of the primary contact recreational standard. The log-mean of the data for the St. Louis Bay at Highway 90 is about 44 colonies/100 mL. This value is well below the 200 colonies cited in the Mississippi state standard. However, the observed 90th percentile for this location is 425 colonies/100 mL--slightly greater than the 400 colonies/100 mL cited in the standard. About 22% of the fecal coliform data for the St. Louis Bay sampling location exceed 200 colonies/100 mL and approximately 11% exceed 400 colonies/100 mL. The log-mean of the data for the Back Bay of Biloxi near Biloxi is 1,160 colonies/100 mL. Approximately 31% of the bacteria data are greater than 200 colonies/100 mL and about 23% of the data are greater than 400 colonies/mL. The fecal coliform data for the Back Bay of Biloxi at Ocean Springs, Mississippi suggest no contraventions of the primary contact recreational standard.

TABLE H-[illegible] (Continued)

TRACE METALS CRITERIA EXCEEDANCE SUMMARY - MISSISSIPPI RIVER

(Freshwater Criteria Exceedances for 24-H Average Concentrations)

	Station #4			Station #5			Station #6		
	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance
Cadmium	26	26	100	26	26	100	98	66	67
Copper	36	34	94	36	36	100	84	75	89
Lead	23	20	87	23	15	65	98	51	52
Mercury	3	2	67	2	0	0	179	26	15
Nickel	-	-	-	-	-	-	83	0	0
Zinc	-	-	-	-	-	-	99	38	38

Sampling Stations -

4: Mississippi River - East Bank at Luling, Louisiana (21LA1ORS S0703450?0) 1/78 to 5/83. Located approximately at river mile 120 AHP.

5: Mississippi River - West Bank at Luling, Louisiana (21LA1ORS S070345080) 1/78 to 5/83. Located approximately at river mile 120 AHP.

6: Mississippi River - At Luling Ferry, Louisiana (112WRD 07374400) 10/57-3/83. Located approximately at river mile 120 AHP.

TABLE [illegible]

TRACE METALS CRITERIA [illegible] SUMMARY - MISSISSIPPI RIVER

(Freshwater Criteria Exceedances for 24-h Average Concentrations)

	Station #1			Station #2			Station #3		
	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance
Cadmium	[illegible]	[illegible]	68	71	51	100	25	25	100
Copper	83	71	86	59	58	98	38	37	97
Lead	[illegible]	50	60	49	27	55	23	12	52
Mercury	170	27	1[illegible]	9	1	11	3	1	33
Nickel	[illegible]	1	1	-	-	-	-	-	-
Zinc	93	[illegible]	45	-	-	-	-	-	-

Sampling Stations -

1: [illegible] ([illegible]) 1/73 to 3/83. Located approximately at river mile 168 Above Head of [illegible].

2: [illegible], Louisiana ([illegible]) 1/78 to 5/83. Located approximately at river mile [illegible].

3: [illegible], Louisiana ([illegible]) 1/78 to [illegible]/83. Located approximately at river mile [illegible].

TABLE H-6-4

FRESHWATER CRITERIA EXCEEDANCES OF SELECTED METALS DETECTED IN THE MISSISSIPPI RIVER

Parameters		Number of Samples	Selected Chronic Exposure Criteria	Percent Exceeding Criteria	24-hour Average Criteria*	Percent Exceeding Criteria	Number of Samples	Maximum Not To Be Exceeded at at Any Time*	Percent Exceeding Criteria
Cadmium,	dissolved	424			Exp [1.05 ln(hardness)-8.53]	31.1	424	Exp [1.05 ln(hardness)-3.73]	3.2
	suspended	207				28.5	207		6.3
	total	273				53.1	273		16.3
Chromium,	hexavalent	393			0.29 ug/L				
	total	301	44 ug/L	0.7				Exp [1.08 ln(hardness)+3.48]	0.0
Copper	dissolved	283			5.6 ug/L	39.6	183	Exp [0.94 ln(hardness)-1.23]	0.6
	suspended	118				51.1	123		7.3
	total	246				81.3	227		17.5
Lead	dissolved	422			Exp [2.35 ln(hardness)-9.48]	5.2			
	suspended	215				39.5			
	total	269				48.3	255	Exp [1.22 ln(hardness)-0.47]	0.0
Mercury,	total	487			0.2 ug/L	39.4	484	4.1 ug/L	0.2
Nickel,	total						36	Exp [0.76 ln(hardness)+4.02]	0.0
Silver,	dissolved	31	0.12 ug/L	3.2			12	Exp [1.26 ln(hardness)-6.52]	0.0
	suspended	11		9.1			12		0.0
	total	13		15.4			15		0.0
Zinc,	dissolved	522			47 ug/L	6.1	417	Exp [0.83 ln(hardness)+1.95]	0.0
	suspended	198				16.2	205		0.5
	total	265				37.0	222		0.9

Source: STORET System

*Maximum and 24-hour average criteria taken from Friday, November 28, 1980, Federal Register, Part V.

TABLE H-6-3 Continued

MEAN CONCENTRATIONS OF SELECTED TRACE METALS AND INORGANICS-MISSISSIPPI RIVER

	Sampling Station Number*									
	1	2	3	4	5	6	7	8	9	Nine Station Aggregate
[illegible]										
Number of Observations	49	-	-	-	-	99	20	63	22	303
Mean	52	-	-	-	-	46	34	65	56	52
Range	[illegible]	-	-	-	-	0-150	0-70	5-570	10-280	0-570
Period of Record	12/[illegible]-1/83	-	-	-	-	12/74-1/83	2/73-4/79	1/75-9/78	10/77-12/82	2/73-1/83
Total Hardness, mg/l CaCO3										
Number of Observations	175	-	-	-	-	505	218	181	56	1,135
Mean	142	-	-	-	-	146	147	144	150	145
Range	[illegible]	-	-	-	-	86-210	93-210	98-200	97-220	86-220
Period of Record	[illegible]-1/83	-	-	-	-	10/57-1/83	8/54-1/83	1/73-9/78	10/77-12/82	8/54-1/83
[illegible] Hardness mg/l CaCO3										
Number of Observations	-	[illegible]	33	39	39	-	-	-	-	166
Mean	-	[illegible]	148	150	151	-	-	-	-	157
Range	-	[illegible]	112-20[illegible]	78-224	68-196	-	-	-	-	68-1,580
Period of Record	-	3/[illegible]-4/83	3/78-4/83	3/78-4/83	3/78-4/83	-	-	-	-	3/78-4/83

* Sampling Stations -

1. Mississippi River at [illegible], Louisiana [illegible] 3/83. Located approximately at river mile 168 Above Head of Passes (AHP).
2. Mississippi River - East Bank at Luteher, Louisiana (21LAI[illegible] 807 345050) 1/78 to 5/83. Located approximately at river mile 148 AHP.
3. Mississippi River - West Bank at Lutcher, Louisiana (21LAI[illegible] 345060) 1/78 to 5/83. Located approximately at river mile 148 AHP.
4. Mississippi River - East Bank at [illegible], Louisiana (21LAI [illegible] 345076) 1/73 to 5/83. Located approximately at river mile 120 AHP.
5. Mississippi River - West Bank [illegible], Louisiana [illegible] 1/78 to 5/83. Located approximately at river mile 120 AHP.
6. Mississippi River [illegible], Louisiana [illegible] 10/57-3/83. Located approximately at river mile 120 AHP.
7. Mississippi River at New Orleans, Louisiana [illegible] 2/53-1/83. Located approximately at river mile 104 AHP.
8. Mississippi River at [illegible], Louisiana [illegible] 1/73-9/78. Location was approximately at river mile 83 AHP.
9. Mississippi River at Belle Chasse, Louisiana (112WRL [illegible]) 8/76-1/83. Located approximately at river mile 76 AHP.

TABLE H-6-3

MEAN CONCENTRATIONS OF SELECTED TRACE METALS AND INORGANICS-MISSISSIPPI RIVER

	Sampling Station Number*									
	1	2	3	4	5	6	7	8	9	Nine Station Aggregate
Cadmium, Total, ug/L										
Number of Observations	97	57	36	34	34	99	21	65	22	465
Mean	3	2	1	2	2	3	4	1	1	2
Range	0-20	0-47	0-8	0-11	0-8	0-25	0-20	0-20	0-30	0-47
Period of Record	12/74-1/83	3/78-4/83	3/78-4/83	3/78-4/83	3/78-4/83	12/74-1/83	2/73-4/79	12/74-9/78	10/77-12/82	2/73-4/83
Chromium, Total, ug/L										
Number of Observations	99	59	42	41	42	99	19	65	21	487
Mean	15	17	16	16	19	15	13	19	12	16
Range	0-30	2-68	2-49	1-49	1-53	0-40	0-20	0-40	0-30	0-68
Period of Record	12/74-1/83	3/78-4/83	3/78-4/83	3/78-4/83	3/78-4/83	12/74-1/83	2/73-4/79	12/74-9/78	10/77-12/82	2/73-4/83
Copper, Total, ug/L										
Number of Observations	83	59	38	36	36	84	20	35	22	413
Mean	17	60	43	228	295	21	10	26	29	70
Range	2-50	5-1,066	5-243	5-816	6-3,995	1-190	0-26	3-450	8-130	0-3,995
Period of Record	1/76-1/83	3/78-4/83	3/78-4/83	3/78-4/83	3/78-4/83	1/76-1/83	2/73-4/79	1/76-9/78	10/77-12/82	2/73-4/83
Lead, Total, ug/L										
Number of Observations	99	55	36	33	33	99	19	65	22	461
Mean	13	11	10	77	35	20	50	13	34	23
Range	0-200	3-55	4-21	2-950	1-354	0-200	0-200	0-200	0-280	0-950
Period of Record	12/74-1/83	4/78-4/83	3/78-4/83	2/79-4/83	2/79-4/83	12/74-1/83	2/73-4/79	12/74-9/78	10/77-12/82	2/73-4/83
Mercury, Total, ug/L										
Number of Observations	179	9	3	3	2	179	38	130	22	565
Mean	0.4	0.1	0.2	1.1	0.0	0.4	0.5	0.5	0.1	0.4
Range	0.0-3.4	0.0-0.3	0.0-0.6	0.0-2.9	0.0-0.1	0.0-5.5	0.0-1.8	0.1-1.8	0.0-0.7	0.0-5.5
Period of Record	1/73-1/83	5/78-9/82	2/81-8/82	2/81-8/82	2/81-4/81	1/73-1/83	4/72-10/82	1/73-9/78	10/77-12/82	4/72-1/83
Nickel, Total, ug/L										
Number of Observations	83	-	-	-	-	83	3	35	12	216
Mean	12	-	-	-	-	13	15	11	11	12
Range	0-130	-	-	-	-	2-90	9-20	2-50	3-23	0-130
Period of Record	1/76-1/83	-	-	-	-	1/76-1/83	1/76-4/79	1/76-9/78	10/79-6/82	1/76-1/83

River. These data indicate that, except for mercury, the dissolved fractions of these constituents are generally lower and less frequently detected, and that the highest trace metal concentrations are normally associated with suspended particulates in the river. The trace metals copper, zinc, and iron have been detected at concentrations of 4.0, 2.2, and 15.1 mg/L, respectively. Mercury has been detected at a concentration of 5.5 ug/L. Such concentrations are generally rare; however, considering the enormous dilution capacity of the river, trace metals at the levels cited are cause for concern. Such high concentrations are indicative of the impact of industrial and urban stormwater discharges to the river. Summary statistics for selected trace metals detected at the nine primary Mississippi River sampling stations considered in detail for this study are shown in table H-6-3. These data show inordinately high mean copper and lead concentrations at the two Luling, Louisiana sampling locations (stations 4 and 5).

H.6.4. An exceedance summary for freshwater aquatic life 24-hour average and maximum exposure criteria (EPA) and selected chronic toxicity criteria is presented in table H-6-4. Freshwater criteria exceedance summaries for the nine primary river sampling locations are shown in tables H-6-5 and H-6-6. The EPA criteria specify pollutant concentrations which, if not exceeded, should protect most, but not necessarily all, aquatic life. The combination of the 24-hour average and maximum values is designed to adequately protect aquatic life and its uses from acute and chronic toxicity and bioconcentration without being as restrictive as a one-number criterion would have to be to provide the same degree of protection. A two-number criterion is intended to describe the highest average ambient water concentration that will produce a water quality generally suited to maintaining aquatic life, while restricting the extent and duration of the excursions over the average to levels that will not cause harm. The maximum value, which is derived from acute toxicity data, is intended to

TABLE H-6-2 (CONTINUED)

AVERAGE DISTRIBUTION BETWEEN DISSOLVED AND SUSPENDED PHASES OF SELECTED TRACE METALS

	River Mile 104 3/			River Mile 83 4/			River Mile 76 5/		
		Average Percentage of Total Concentration			Average Percentage of Total Concentration			Average Percentage of Total Concentration	
Trace Metals	Number of Samples	Dissolved	Suspended	Numbers of Samples	Dissolved	Suspended	Number of Samples	Dissolved	Suspended
Cadmium	6	19.7	80.3	23	29.8	70.2	11	70.6	29.4
Chromium	11	33.5	66.5	-	-	-	11	33.3	66.7
Copper	16	53.5	46.5	35	52.2	47.8	20	32.1	67.9
Lead	15	5.8	94.2	64	16.2	83.8	17	11.9	88.1
Mercury	14	90.8	9.2	65	94.4	5.6	14	66.3	33.7
Nickel	1	15.0	85.0	35	29.9	70.1	11	33.5	66.5
Zinc	15	51.0	49.0	63	46.7	53.3	20	56.2	43.8

1/ 112WRD 07374220: Mississippi River @ Union, LA

2/ 112WRD 07374400: Mississippi River @ Luling Ferry, LA

3/ 112WRD 07374508: Mississippi River @ New Orleans, LA

4/ 112WRD 07374522: Mississippi River @ Violet, LA

5/ 112WRD 07374525: Mississippi River @ Belle Chasse, LA

TABLE H-6-2

AVERAGE DISTRIBUTION BETWEEN DISSOLVED AND SUSPENDED PHASES OF SELECTED TRACE METALS

	Five Station Composite Averages			River Mile 168 1/			River Mile 120 2/		
		Average Percentage of Total Concentration			Average Percentage of Total Concentration			Average Percentage of Total Concentration	
Trace Metals	Number of Samples	Dissolved	Suspended	Number of Samples	Dissolved	Suspended	Number of Samples	Total Dissolved	Suspended
Cadmium	130	43.6	56.4	45	45.5	54.5	45	45.2	54.8
Chromium	22	33.4	66.6	-	-	-	-	-	-
Copper	223	43.3	56.7	75	42.9	57.1	77	40.3	59.7
Lead	267	13.3	86.7	86	13.4	86.6	85	12.6	87.4
Mercury	249	78.8	21.2	77	74.2	25.8	79	70.5	29.5
Nickel	194	29.3	70.7	74	27.6	72.4	73	30.3	69.2
Zinc	275	40.0	60.0	87	36.5	63.5	90	36.1	63.9

TABLE H-6-1

CHARACTERIZATION OF SELECTED METALS AND METALLOIDS MEASURED IN THE MISSISSIPPI RIVER*

Parameter		Number of Samples	Percent of Samples in which Parameter Was Not Detected	Mean Concentration ug/L	Observed Concentration (ug/L) Was Less than or Equal to That Stated 99% of the time	Period of Record
Arsenic	dissolved	501	10.7	3.6	24.2	10/01/62 - 8/05/80
	total	248	0.7	4.0	52	1/21/74 - 8/05/80
Cadmium	dissolved	523	30.3	1.1	17	10/01/62 - 8/05/80
	total	299	17.4	2.5	25	2/01/73 - 8/05/80
Chromium	dissolved	139	19.4	2.1	20	10/01/62 - 7/09/80
	total	301	4.7	13.1	50	2/01/73 - 8/05/80
	hexavalent	393	-	2.5	-	10/20/70 - 8/05/80
Copper	dissolved	283	2.5	6.0	21	10/01/62 - 8/05/80
	total	211	0.7	27.9	245	2/01/73 - 8/05/80
Iron	dissolved	418	11.4	28.3	230	4/05/72 - 8/05/80
	total	93	0	3,806	15,100	10/01/62 - 7/09/80
Lead	dissolved	521	24.7	2.6	30	10/01/62 - 8/05/80
	total	292	1.6	17.0	110	2/01/73 - 8/05/80
Manganese	dissolved	6,565	12.4	11.7	120	4/05/72 - 7/09/80
	total	53	0	114	360	10/01/62 - 7/09/80
Mercury	dissolved	286	34.9	0.04	0.8	4/11/74 - 8/05/80
	total	457	14.8	0.23	1.6	4/05/72 - 8/05/80
Nickel	dissolved	252	13.0	2.8	16	10/01/62 - 8/05/80
	total	142	3.0	10.7	90	8/28/75 - 8/05/80
Zinc	dissolved	522	11.3	15.1	110	10/01/62 - 8/05/80
	total	254	0.4	67.7	610	2/01/73 - 8/05/80

Source: STORET System

* Data from 38 sampling stations in the reach river mile 155 AHP to river mile 75 AHP.

Section 6. TRACE METALS - EXISTING CONDITIONS

H.6.1. Trace metals and trace inorganics enter surface waters via several routes and from many sources. Fallout and washout of contaminants from the polluted atmosphere of urban and highly industrialized areas can be significant nonpoint sources. Metallic salts leached from soils and natural ore deposits can also contribute significantly to the the trace metal content of a surface water body. For the most part, heavy waste loading to neighboring surface waters is a consequence of the continuing proliferation of industrial establishments adjacent to the Mississippi River and the general industrialization of the New Orleans-Baton Rouge urban corridor (see plate H-8). Several metals that are frequent components of many industrial wastewaters and urban stormwater runoff have been detected at high concentrations in the Mississippi River. These metals are rarely found in more than trace quantities in unpolluted waters.

H.6.2. Data from long-term monitoring of trace metals concentrations were not available for each of the study area water bodies addressed in previous sections of this appendix. Consequently, only those areas where sufficient trace metals data were available to be considered adequately representative of typical conditions are addressed in this section.

MISSISSIPPI RIVER

H.6.3. Trace metals and selected trace inorganics routinely detected in the Mississippi River are characterized in table H-6-1. Data for dissolved and total concentrations of nine selected trace metals and one trace inorganic is presented. Table H-6-2 shows the observed average distribution between dissolved and suspended fractions of the total concentration of selected trace metals measured in the Mississippi

TABLE H-5-11

OBSERVED FECAL COLIFORM BACTERIA DENSITIES* - PASCAGOULA AND ESCATAWPA RIVERS

	West Pascagoula River - Hwy 90 at Gautier, MS 1/	Pascagoula River - Hwy 90 at Pascagoula, MS 2/	Pascagoula River - Mile 0 to Mile 13 3/	Escatawpa River - Moss Point to Mile 5 4/
Number of Observations	87	46	144	181
Mean (logarithmic)	122	233	158	442
Range	7-6,000	10-8,000	5-8,000	7-53,000
Period of Record	9/74-3/83	9/72-7/82	9/72-7/82	11/71-3/83
Weighted Percentiles				
5	10	14	10	13
10	20	30	10	51
20	37	87	31	91
30	67	122	74	155
40	80	180	100	285
50 (median)	120	240	177	500
60	135	386	250	704
80	290	506	680	2,660
90	2,200	1,070	1,300	5,160
95	4,060	4,600	2,200	6,540

* Number of colonies per 100 mL.

1/ West Pascagoula River - Hwy 90 at Gautier, Mississippi (21MSWQ 02480285, 8/75 to 3/83; 112WRD 02480285, 9/72 to 9/75)

2/ Pascagoula River - Hwy 90 at Pascagoula, Mississippi (21MSWQ 02480210, 8/75 to 6/77; 112WRD 02480210, 9/72 to 7/82)

3/ Pascagoula River - Mile 0 to Mile 13. Aggregate of data for 15 sampling locations - 21MSWQ: 02480210; 112WRD: 02480215, 02480212, 02480210, 302319088335400, .02345088343800, 302430088350400, 302507088342800, 302507088342800, 302526088333600, 02479343, 302648088340600, 302725088333700, 302822088332500, 02479342, 02479341.

4/ Escatawpa River - Moss Point to Mile 5. Aggregate of data for 7 sampling locations - 21MSWQ: 02480207; 112WRD 02480207, 02480208, 302459088320800, 302455088313100, 302528088304400, 302515088301300.

PASCAGOULA AND ESCATAWPA RIVERS

H.5.18. The sanitary quality of the Pascagoula Rivers at Highway 90, as characterized by samples of observed fecal coliform densities is presented in table H-5-11. These data suggest frequent contraventions of the primary contact recreational standard for the Pascagoula River at Highway 90. The log-mean of the data is about 233 colonies/100 mL and the 90th percentile is 1,070 colonies/ 100 mL. Both of these values are greater than those cited in the primary contact standard. About 57% of these data exceed 200 colonies/100 mL and about 39% exceed 400 colonies/100 mL. Occasional contraventions of the primary contact standard are implied by the fecal coliform data for the West Pascagoula River at Highway 90. The log-mean of the data is shown as about 122 colonies 100/ mL -- well below the 200 colonies/100 mL cited in the state standard. However, the 90th percentile of the distribution is shown as 2,200 colonies/100 mL much greater that the 400 colonies/100 mL cited in the state standard. About 23% of these data exceed 200 colonies/100 mL and about 14 percent exceed 400 colonies/100 mL.

H.5.19. Aggregate data for the Pascagoula River from mile 0 to mile 13, inclusive of the data for the Pascagoula River at Highway 90, have a log-mean of 158 colonies/100 mL. The 90th percentile value is shown as 1,300 colonies/100 mL. About 44% of these data exceed 200 colonies/100 mL and about 35% exceed 400 colonies/100 mL. The Escatawpa River is classified as suitable for fishing and for propagation of fish, aquatic life, and wildlife. The state standard for this classification cites a geometric (logarithmic) mean of 2,000 colonies/100 mL and a 90th percentile value of 4,000 colonies/100 mL. As indicated, the aggregate data for the Escatawpa River from Moss Point to mile 5 shows a log-mean of about 442 colonies/100 mL and a 90th percentile value of about 5,160 colonies/100 mL. Although these values are considerably higher than those shown for the Pascagoula and West Pascagoula Rivers, they are generally comparable to values cited previously for the Mississippi River. About 24% of the Escatawpa River fecal coliform data exceed 2,000 colonies/100 mL and about 13% exceed 4,000 colonies/100 mL.

TABLE H-5-10

OBSERVED FECAL COLIFORM BACTERIA DENSITIES* - SELECTED MISSISSIPPI COASTAL RIVER BASIN WATERS

	St. Louis Bay - Hwy 90 at Bay St. Louis, MS 1/	Back Bay of Biloxi near Biloxi, MS 2/	Back Bay of Biloxi at Ocean Springs, MS 3/
Number of Observations	91	91	32
Means (logarithmic)	44	106	46
Range	1-6,000	5-6,000	1-600
Period of Record	9/74-3/83	9/74-3/83	9/74-6/77
Weighted Percentiles			
5	3	7	1
10	7	10	2
20	10	20	12
30	10	52	28
40	13	67	50
50 (median)	40	120	74
60	78	134	112
80	240	610	147
90	425	1,160	328
95	1,860	2,100	476

* Number of colonies per 100 mL.

1/ St. Louis Bay - Hwy 90 at Bay St. Louis, Mississippi (21MSWO 02481675 8/75 to 3/83, 112WRD 02481675 2/74 to 7/77).
2/ Back Bay of Biloxi near Biloxi, Mississippi (21MSWO 02481270 8/75-3/83, 112WRD 02481270 6/73 to 6/77)
3/ Back Bay of Biloxi at Ocean Springs, Mississippi (21MSWO 02481300 8/75 to 6/77, 112WRD 02481300 6/73 to 6/77)

TABLE H-5-9

Observed Fecal Coliform Bacteria
Densities* - West Mississippi Sound

	West Mississippi Sound 1/
Number of Observations	60
Mean (logarithmic)	8
Range	1-530
Period of Record	8/72-5/75
Weighted Percentiles	
5	0
10	0
20	0
30	2
40	6
50 (median)	9
60	16
80	40
90	74
95	85

* Number of colonies per 100 mL.

1/ West Mississippi Sound. Aggregate data for four sampling locations - 113S000: 780238; 11COELMN: 05009, 05010; 112WRD 301120089251000.

TABLE H-6-5 (Continued)

TRACE METALS CRITERIA EXCEEDANCE SUMMARY - MISSISSIPPI RIVER

(Freshwater Criteria Exceedances For 24-h Average Concentrations)

	Station #7			Station #8			Station #9		
	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance
Cadmium	20	7	35	65	23	35	21	18	86
Copper	20	12	60	35	22	63	22	22	100
Lead	19	12	63	65	30	46	21	14	67
Mercury	38	6	16	130	6	5	22	6	27
Nickel	3	0	0	35	0	0	12	0	0
Zinc	20	5	25	63	27	43	22	10	45

Sampling Stations -

7: Mississippi River at New Orleans, Louisiana (112WRD 07374508) 2/53-1/83. Located approximately at river mile 104 AHP.

8: Mississippi River at Violet, Louisiana (112WRD 07374522) 1/73 to 9/78. Location was approximately at river mile 83 AHP.

9: Mississippi River at Belle Chasse, Louisiana (112WRD 07374525) 8/76 to 1/83. Located approximately at river mile 76 AHP.

TABLE H-6-5 (Continued)

TRACE METALS CRITERIA EXCEEDANCE SUMMARY - MISSISSIPPI RIVER

(Freshwater Criteria Exceedances For 24-h Average Concentrations)

	Nine Sampling Station Aggregate		
	No. of Samples	No. of Exceedances	Percent Exceedance
Cadmium	428	307	72
Copper	413	367	89
Lead	419	240	57
Mercury	565	75	13
Nickel	216	1	0
Zinc	303	125	41

TABLE H-6-6

TRACE METALS CRITERIA EXCEEDANCE SUMMARY - MISSISSIPPI RIVER

(*Freshwater Criteria Exceedances for Instantaneous* Maximum Concentrations)

	Station #1			Station #2			Station #3		
	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance
Cadmium	96	16	17	51	3	6	25	0	0
Chromium	98	0	0	53	0	0	26	0	0
Copper	82	9	11	53	27	51	27	12	44
Lead	98	0	0	49	0	0	23	0	0
Mercury	179	0	0	9	0	0	3	0	0
Nickel	63	0	0	-	-	-	-	-	-
Zinc	98	0	0	-	-	-	-	-	-

Sampling Stations -

1. Mississippi River at Union, Louisiana (112WRD 07374220) 1/73 to 3/83. Located approximately at river mile 168 Above Head of Passes (AHP).
2. Mississippi River - East Bank at Lutcher, Louisiana (21LAIRS B070345050) 1/78 to 5/83. Located approximately at river mile 148 AHP
3. Mississippi River - West Bank at Lutcher, Louisiana (21LAIORS S070345060) 1/78 to 5/83. Located approximately at river mile 148 AHP

TABLE H-6-6 (Continued)

TRACE METALS CRITERIA EXCEEDANCE SUMMARY - MISSISSIPPI RIVER

(Freshwater Criteria Exceedances For Instantaneous Maximum Concentrations)

	Station #4			Station #5			Station #6		
	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance
Cadmium	26	2	8	26	1	4	98	14	14
Chromium	29	0	0	30	0	0	98	0	0
Copper	28	23	82	28	25	89	83	14	17
Lead	23	2	9	23	1	4	98	0	0
Mercury	3	0	0	2	0	0	179	1	1
Nickel	-	-	-	-	-	-	83	0	0
Zinc	-	-	-	-	-	-	98	0	0

Sampling Stations -

4: Mississippi River - East Bank at Luling, Louisiana (21LA1ORS S070345070) 1/78 to 5/83. Located approximately at river mile 120 AHP.

5: Mississippi River - West Bank at Luling, Louisiana (21LA1ORS S070345080) 1/78 to 5/83. Located approximately at river mile 120 AHP.

6: Mississippi River - At Luling Ferry, Louisiana (112WRD 07374400) 10/57-3/83. Located approximately at river mile 120 AHP.

TABLE H-6-6 (Continued)

TRACE METALS CRITERIA EXCEEDANCE SUMMARY - MISSISSIPPI RIVER

(Freshwater Criteria Exceedances For Instantaneous Maximum Concentrations)

	Station #7			Station #8			Station #9		
	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance
Cadmium	20	4	20	65	2	3	21	4	19
Chromium	19	0	0	65	0	0	20	0	0
Copper	20	0	0	35	3	9	21	4	19
Lead	19	0	0	65	0	0	21	0	0
Mercury	38	0	0	180	0	0	22	0	0
Nickel	3	0	0	35	0	0	12	0	0
Zinc	20	0	0	63	1	2	21	0	0

Sampling Stations -

7: Mississippi River at New Orleans, Louisiana (112WRD 07374508) 2/53-1/83. Located approximately at river mile 104 AHP.

8: Mississippi River at Violet, Louisiana (112WRD 07374522) 1/73 to 9/78. Location was approximately at river mile 83 AHP.

9: Mississippi River at Belle Chasse, Louisiana (112WRD 07374525) 8/76 to 1/83. Located approximately at river mile 76 AHP.

TABLE H-6-6 (Continued)

TRACE METALS CRITERIA EXCEEDANCE SUMMARY MISSISSIPPI RIVER

(Freshwater Criteria Exceedances for Instantaneous Maximum Concentrations)

	Nine Sampling Station Aggregate		
	No. of Samples	No. of Exceedances	Percent Exceedance
Cadmium	428	46	11
Chromium	438	0	0
Copper	413	117	28
Lead	419	3	1
Mercury	615	1	0
Nickel	216	0	0
Zinc	300	1	0

prevent significant risk of adverse impact to organisms exposed to concentrations above the 24-hour average. All of the criteria are for the concentration of total recoverable metal present in a sample. The freshwater criteria for 24-hour average concentrations of cadmium and lead, and for instantaneous maximum cadmium, chromium, copper, lead, nickel, silver, and zinc concentrations vary directly with water hardness. Carbonate hardness was used to derive hardness dependent criteria when no value of total hardness was measured for an individual sample. The data of table H-6-3 show mean total hardness in the Mississippi river to be about 145 mg/L-$CaCO_3$. The selected chronic toxicity criteria are concentrations that have been shown to produce a chronic response in a particular freshwater organism. Among species that are more sensitive than those tested, chronic effects would occur at lower concentrations.

H.6.5. All data to which the criteria were compared were obtained from analyses of grab samples. Comparing 24-hour average criteria with data obtained from grab samples may be misleading. However, considering the relatively extensive data base and extended period over which samples were collected, such a comparison appears to provide a good indication of whether potential problems exist.

H.6.6. The data of tables H-6-4 through H-6-6 show that the trace metals cadmium and copper consistently exceed both the 24-hour average and maximum freshwater criteria. These data also indicate potential problems associated with recurrent high concentrations of iron, mercury, zinc, and lead.

H.6.7. Mean concentrations of selected trace metals measured in major freshwater tributaries to Lake Pontchartrain are indicated in table H-6-7. Summary statistics for Lake Maurepas, Tangipahoa, and Tchefuncta River sampling locations are shown. Mean cadmium concentrations in the tributary water bodies are comparable to those computed for the Mississippi River; computed mean chromium and zinc concentrations appear to be generally lower. Except for the Lake Maurepas sampling location, mean lead concentrations for the tributary water bodies seem generally higher than those computed for most of the Mississippi River sampling stations. Only a few observations of mercury concentrations have been made for several of the tributary sampling locations; consequently, some of the mean concentrations shown are not representative of typical conditions. However, as indicated in the table, some notably high individual mercury concentrations have been detected at the Pass Manchac, Tangipahoa, and Tchefuncta River sampling locations. Comparing the summary statistics of table H-6-7 with those of table H-6-3 for the Mississippi River also suggests generally lower mean water hardness in the Lake Pontchartrain tributaries, except for locations influenced by brackish inflows. Consequently, generally more stringent (i.e. lower) hardness dependent freshwater critera are applicable to the tributary waters.

H.6.8. Summaries of freshwater criteria exceedances for 24-hour average and instantaneous maximum trace metals concentrations are shown on table H-6-8 and H-6-9. These summaries imply consistant exceedances of the criteria for 24-hour average concentrations, by the grab sample data, for cadmium, copper, and lead at each of the selected tributary sampling locations. Relatively high exceedance ratios for mercury and zinc are also apparent for some sampling locations. The summaries of exceedances of the instantaneous maximum criteria indicate potential problems with

TABLE II-6-7

Mean Concentrations of Selected Trace Metals and Inorganics -
Selected Tributaries to Lake Pontchartrain

	Sampling Station Number * 1	2	3	4	5	6
Cadmium, Total, ug/L						
Number of Observations	139	58	58	73	54	36
Mean	1	3	2	2	2	3
Range	0-29	0-19	0-7	0-11	0-22	0-15
Period of Record	4/75-1/81	3/78-4/83	3/78-4/83	3/78-4/83	1/78-4/83	3/78-4/83
Chromium, Total ug/L						
Number of Observations	139	60	60	75	60	42
Mean	13	5	3	5	5	4
Range	0-30	0-40	0-12	0-27	0-31	0-31
Period of Record	[illegible]/75-1/81	3/78-4/83	3/78-4/83	3/78-4/83	1/78-4/83	3/78-4/83
Copper, Total, ug/L						
Number of Observations	116	59	61	75	57	39
Mean	6	304	333	281	518	399
Range	0-70	8-1,295	20-1,192	0-1,712	9-4,405	76-988
Period of Record	1/76-1/81	3/78-4/83	3/78-4/83	3/78-4/83	1/78-4/83	3/78-4/83
Lead, Total, ug/L						
Number of Observations	139	55	55	70	50	33
Mean	12	45	38	42	40	35
Range	0-200	4-441	8-151	0-489	0-440	13-1[illegible]3
Period of Record	[illegible]/75-1/81	4/78-4/83	4/78-4/83	4/78-4/83	1/78-4/83	2/79-4/83
Mercury, Total, ug/L						
Number of Observations	139	9	9	31	23	3
Mean	0.2	0.5	0.3	0.4	0.1	1.2
Range	0.0-[illegible].5	0.0-1.0	0.0-0.7	0.0-3.1	0.0-0.5	0.0-3.6
Period of Record	[illegible]/75-1/81	5/78-9/82	5/78-9/82	1/73-9/82	3/74-8/82	2/[illegible]1-8/82
Nickel, Total, ug/L						
Number of Observations	114	-	-	12	12	-
Mean	5	-	-	3	3	-
Range	0-50	-	-	0-8	0-5	-
Period of Record	1/7[illegible]-1/81	-	-	10/79-6/82	10/79-6/82	-

[illegible]						
[illegible] Observations	137	-	[illegible]	[illegible]	[illegible]	-
Mean	23	-	[illegible]	[illegible]	29	-
Range	[illegible]-110	-	[illegible]	[illegible]	6-96	-
Period of Record	[illegible]-1/81	-	-	[illegible]	[illegible]	-
Total Hardness, mg/L-$CaCO_3$						
Number of Observations	[illegible]	-	-	[illegible]	309	-
Mean	74	-	-	[illegible]	[illegible]	-
Range	11-44[illegible]	-	-	[illegible]	[illegible]-97	-
Period of Record	4/75-1/81	-	-	[illegible]-10/82	6/58-10/82	-
Carbonate Hardness, mg/L-$CaCO_3$						
Number of Observations	-	[illegible]	[illegible]	[illegible]	34	34
Mean	-	29[illegible]	[illegible]	16	19	110
Range	-	27-1,732	[illegible]-34	[illegible]	0-136	0-526
Period of Record	-	3/78-4/83	3/78-4/83	3/78-4/83	3/78-4/83	3/78-4/83

* Sampling Locations -

1: Middle of Lake Maurepas near Manchac, Louisiana (112WRD 30[illegible]) 4/75 to 1/81. About one-third of the data (about 50 samples) were accumulated during the period April 16, 1979 to June 14, 1979.

2: Pass Manchac, East of US Highway 51 (21LA1ORS B041705010) 3/78-4/83.

3: Tangipahoa River at Higway 38 Bridge (21LA1ORS B042180010) 3/78-4/83.

4: Tangipahoa River at US Highway 190 Bridge (21LA1ORS B042180030, 3/78-4/83; 112WRD 07375500, 10/43-1/83).

5: Tchefuncta River at US Highway 190 Bridge (21LA1ORS S042200010, 3/78-4/83; 112WRD 07375050, 10/43-1/83).

6: Tchefuncta River at Highway 22 Bridge (21LA1ORS S042200020, 3/78-4/83).

TABLE H-6-9

Trace Metals Criteria Exceedance Summary - Selected Tributaries to Lake Pontchartrain

(Freshwater Criteria Exceedances for 24-h Average Concentrations)

	Station #1 No. of Samples	Station #1 No. of Exceedances	Station #1 Percent Exceedance	Station #2 No. of Samples	Station #2 No. of Exceedances	Station #2 Percent Exceedance	Station #3 No. of Samples	Station #3 No. of Exceedances	Station #3 Percent Exceedance
Cadmium	139	55	40	51	51	100	53	53	100
Copper	[illegible]	[illegible]	24	59	59	100	61	61	100
Lead	[illegible]	[illegible]	72	48	24	50	50	50	100
Mercury	[illegible]	[illegible]	3	9	4	44	9	4	44
[illegible]	[illegible]			–	–	–	–	–	–
[illegible]	[illegible]	–		–	–	–	–	–	–

[illegible] Manchac, Louisiana [illegible] 75 to 1981. About one-third of the data (about 50 [illegible] during the period April [illegible] 11, 1979.

[illegible] Highway 51 (21LA[illegible]

[illegible] Highway 38 Bridge (21LA[illegible]

TABLE H-4-9 (Continued)

Trace Metals Criteria Exceedance Summary - Selected Tributaries to Lake Pontchartrain

(Freshwater Criteria Exceedances for 24-h Average Concentrations)

	Station #4			Station #5			Station #6		
	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance
Cadmium	67	59	88	42	35	83	23	23	100
Copper	75	64	85	57	44	77	39	39	100
Lead	64	62	97	38	37	97	19	15	79
Mercury	31	7	23	23	3	13	3	1	33
Nickel	12	0	0	12	0	0	-	-	-
Zinc	14	2	14	17	1	6	-	-	-

Sampling Locations

4: Tangipahoa River at US Highway 190 Bridge (21LA1ORS B042180030, 3/78-4/83; 112WRD 07375050, 10/43-1/83).

5: Tchefuncta River at US Highway 190 Bridge (21LA1ORS S042200010, 3/78-4/83; 112WRD 07375050, 10/43-1/83).

6: Tchefuncta River at Highway 22 Bridge (21LA1ORS S042200020, 3/78-4/83).

TABLE B-I-9

Trace Metals Criteria Exceedance Summary - Selected Tributaries to Lake Pontchartrain

(Freshwater Criteria Exceedances for Instantaneous Maximum Concentrations)

	Station #1			Station #2			Station #3		
	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance
Cadmium	139	41	29	51	6	12	53	49	92
Chromium	139	0	0	53	0	0	55	0	0
Copper	116	14	12	52	49	94	56	56	100
Lead	139	5	4	48	1	2	50	35	70
Mercury	139	[illegible]	[illegible]	0	0	0	0	0	0
Nickel	[illegible]	0	0	-	-	-	-	-	-
Zinc	137	1	1	-	-	-	-	-	-

1: [illegible] Lake Maurepas near Manchac, Louisiana (112WRD 301500090300060) 4/75 to 1/81. About one-third of the data (about 50 samples) were accumulated during the period April 16, 1979 to June 14,1979.

2: Pass Manchac, East of [illegible] (21[illegible] RS R04[illegible]) 3/78-4/83.

3: [illegible] River at [illegible] Bridge (21LA[illegible] 3042[illegible]) 3/78-4/83.

TABLE [illegible] (Continued)

Trace Metals Criteria Exceedance Summary - Selected Tributaries to Lake Pontchartrain

(Freshwater Criteria Exceedances for Instantaneous Maximum Concentrations)

	No. of Samples	Station #4 No. of Exceedances	Percent Exceedances	No. of Samples	Station #5 No. of Exceedances	Percent Exceedances	No. of Samples	Station #6 No. of Exceedances	Percent Exceedances
Cadmium	67	54	81	42	34	81	13	10	43
Chromium	69	0	0	43	0	0	24	0	0
Copper	69	66	96	44	42	95	25	25	100
Lead	64	37	58	38	25	66	19	5	26
Mercury	31	0	0	23	0	0	3	0	0
Nickel	12	0	0	12	0	0	-	-	-
Zinc	14	2	14	17	2	14	-	-	-

4: Tangipahoa River at US Highway 190 Bridge (21LA1ORS B042180030, 3/78-4/83; 112WRD 07375050, 10/43-1/83).

5: Tchefuncta River at US Highway 190 Bridge (21LA1ORS S042200010, 3/78-4/83; 112WRD 07375050, 10/43-1/83).

6: Tchefuncta River at Highway 22 Bridge (21LA1ORS S042200020, 3/78-4/83).

TABLE H-6-15

ean Concentrations of Selected Trace Metals and Inorganics - Pearl River

	West Pearl River at Hwy. 90 Bridge 1/	East Pearl River at Hwy. 90 Bridge 2/
bonate Hardness mg/L-$CaCO_3$		
umber of Observations	35	54
ean	23	366
ange	0-130	0-2,190
eriod of Record	3/78-4/83	3/78-4/83
mium, Total, ug/L		
umber of Observations	36	58
ean	1	4
ange	0-4	0-110
eriod of Record	3/78-4/83	3/78-4/83
omium, Total, ug/L		
umber of Observations	42	60
ean	6	5
ange	2-21	0-13
eriod of Record	3/78-4/83	3/78-4/83
d, Total, ug/L		
umber of Observations	34	55
ean	28	26
ange	0-241	2-141
eriod of Record	2/79-4/83	4/78-4/83
cury, Total, ug/L		
umber of Observations	3	9
ean	0.2	0.2
ange	0.0-0.4	0.0-0.7
eriod of Record	2/81-8/82	5/78-9/82

West Pearl River at Highway 90 Bridge (21LA1ORS S090465020)

East Pearl River at highway 90 Bridge (21LA1ORS B090465010)

TABLE H-6-14

TRACE METALS CRITERIA EXCEEDANCE SUMMARY - GULF INTRACOASTAL WATERWAY AND MISSISSIPPI RIVER-GULF OUTLET

Saltwater Criteria Exceedances for 24-hour Average Concentrations

	GIWW near Paris Rd.[1]			MR-GO at Bayou Dupre[2]			MR-GO at mi. -5.0 (Breton Sound)[3]		
	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance
Cadmium	177	10	6	34	0	0	35	0	0
Copper	69	34	49	34	16	47	35	12	34
Mercury	115	8	7	34	1	3	36	6	17
Nickel	69	4	6	34	4	12	36	1	3
Zinc	114	14	12	31	2	6	32	13	41

1/ Gulf Intracoastal Waterway near Paris Rd. (112WRD 300240895605OO)

2/ Mississippi River-Gulf Outlet at Bayou Dupre (112WRD 295623089501800)

3/ Mississippi River-Gulf Outlet at mile -5.0 - Breton Sound (112WRD 292730089032200)

TABLE H-6-13

MEAN CONCENTRATIONS OF SELECTED TRACE METALS

Gulf Intracoastal Waterway and Mississippi River-Gulf Outlet

	GIWW near Paris Rd[1]	MRGO at Bayou Dupre[2]	MRGO at mi. -5.0 (Breton Sound)[3]
dmium, Total, ug/L			
Number of Observations	177	34	35
Mean	3	1	1
Range	0-30	0-22	0-2
Period of Record	6/74-7/82	1/78-1/81	6/76-1/81
pper, Total, ug/L			
Number of Observations	69	34	35
Mean	7	6	4
Range	0-50	0-21	0-32
Period of Record	1/76-7/82	1/78-1/81	7/76-1/81
rcury, Total, ug/L			
Number of Observations	115	34	36
Mean	0.4	0.1	0.1
Range	0.0-0.7	0.0-0.6	0.0-1.2
Period of Record	7/74-7/82	1/78-1/81	6/76-1/81
ckel, Total, ug/L			
Number of Observations	69	34	36
Mean	8	4	3
Range	0-200	0-11	0-19
Period of Record	1/76-7/82	1/78-1/81	6/76-1/81
nc, Total, ug/L			
Number of Observations	114	31	32
Mean	36	32	48
Range	4-340	10-80	10-110
Period of Record	6/74-7/82	1/78-1/81	4/77-1/81

Gulf Intracoastal Waterway near Paris Rd. (112WRD 300024089560500)

Mississippi River-Gulf Outlet at Bayou Dupre (112WRD 295623089501800)

Mississippi River-Gulf Outlet at mile -5.0 - Breton Sound (112WRD 2730089032200)

H-6-12) suggest relatively rare instances of measured concentrations being greater than the criteria.

GULF INTRACOASTAL WATERWAY AND MISSISSIPPI RIVER-GULF OUTLET

H.6.11. Summary statistics for concentrations of selected trace metals detected in the Gulf Intracoastal Waterway (GIWW) near Paris Road and two locations on the Mississippi River-Gulf Outlet (MR-GO) are shown in table H-6-13. As is indicated on the table, the computed mean concentrations of cadmium, copper, mercury, nickel, and zinc are generally comparable to mean values computed for Lake Pontchartrain.

H.6.12. Trace metal concentrations measured in these water bodies which exceeded the EPA 24-hour average saltwater criteria are summarized in table H-6-14. Generally, consistant exceedances of the criteria are apparent for copper concentrations measured at each location. Potential problems with high zinc concentrations at the GIWW and MR-GO at Breton Sound sampling locations are also implied. Additionally, relatively high criteria exceedance ratios are indicated for nickel measured in the MR-GO at Bayou Dupre and for mercury in the MR-GO at Breton Sound.

PEARL RIVER

H.6.13. Mean concentrations of selected trace metals measured at two Pearl River sampling locations are summarized in table H-6-15. As can be noted by examining this table, the computed mean concentrations of chromium, lead, and mercury are comparable for the West and East Pearl River sampling locations. However, the mean cadmium concentrations indicate that generally higher values have been measured for the East Pearl. Also, higher mean water hardness is apparent for the East Pearl sampling location. The higher water hardness implies that higher trace

TABLE H-6-12 (Continued)

TRACE METALS CRITERIA EXCEEDANCE SUMMARY - LAKE PONTCHARTRAIN

Saltwater Criteria Exceedances for Instantaneous Maximum Concentrations

	Station #10 No. of Samples	Station #10 No. of Exceedances	Station #10 Percent Exceedance	Station #11 No. of Samples	Station #11 No. of Exceedances	Station #11 Percent Exceedance	[illegible] No. of Samples	[illegible] No. of Exceedances	[illegible] Percent Exceedance
Cadmium	19	0	0	158	0	[illegible]	[illegible]	[illegible]	[illegible]
Copper	49	0	0	112	1	[illegible]	[illegible]	[illegible]	[illegible]
Mercury	49	0	0	157	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Nickel	49	0	0	111	0	0	[illegible]	[illegible]	[illegible]
Zinc	19	0	0	155	0	[illegible]	[illegible]	[illegible]	[illegible]

Sampling Locations -

10: Lake Pontchartrain 0.9 miles North of Pointe Aux Herbes, LA (112WRD [illegible]) 4/79-6/79. Temporary sampling station for water quality monitoring during 1979 diversion of flood flows through the Bonnet Carre' Floodway.

11: Lake Pontchartrain at Inner Harbor Navigation Canal (112WRD [illegible]) 6/74-1/81. Approximately one-third of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

12: Lake Pontchartrain at Mid Causeway (112WRD 301160090073300) 6/74-1/81. Approximately one-third of the data (about [illegible] samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

TABLE H-6-12 (Continued)

TRACE METALS CRITERIA EXCEEDANCE SUMMARY-LAKE PONTCHARTRAIN

Saltwater Criteria Exceedances for Instantaneous Maximum Concentration

	Station #7			Station #8			Station #9		
	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance
Cadmium	[illegible]	0	0	68	0	0	36	0	[illegible]
Copper	-	-	-	68	0	0	-	-	-
Mercury	[illegible]	0	0	67	0	0	3	0	0
Nickel	-	-	-	67	0	0	3	0	0
Zinc	-	-	-	67	0	0	-	-	-

[illegible]

[illegible] at US Highway 90 Bridge (21LA1@@S 8011708010) 3/78-4/83.

[illegible] 2.? miles [illegible] of Chef Menteur, LA (112WRD 300555089400300) 4/79-1/81. Approximately 70 percent of the data [illegible] were accumulated during the 197? diversion of flood flows throuh the Bonnet Carre' Floodway.

[illegible] Menteur Pass at US Highway 90 Bridge (21LA1@@S 8040615010) 3/78-4/83.

TABLE H-6-12 (Continued)

TRACE METALS CRITERIA EXCEEDANCE SUMMARY - LAKE PONTCHARTRAIN

Saltwater Criteria Exceedances for Instantaneous Maximum Concentrations

	Station #4			Station #5			Station #6		
	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance
Cadmium	158	0	0	156	0	0	68	0	0
Copper	111	1	1	108	1	1	68	0	0
Mercury	155	0	0	153	0	0	67	0	0
Nickel	112	0	0	108	0	0	68	0	0
Zinc	158	0	0	155	0	0	66	0	0

Sampling Locations -

4: Lake Pontchartrain at Mouth of Techefuncta River, near Madisonville, LA (112WRD 302130090102000) 6/74-1/81. Approximately one-third of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

5: Lake Pontchartrain at Mouth of Bayou LaCombe, near LaCombe, LA (112WRD 301500089572000) 6/74-1/81. Approximately one-third of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

6: Lake Pontchartrain at West Rigolets, 5.7 miles SSE of Slidell, LA (112WRD 301015089351500) 4/79-1/81. Approximately 7[illegible] percent of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

TABLE B-6-12

TRACE METALS CRITERIA EXCEEDANCE SUMMARY - LAKE PONTCHARTRAIN

Saltwater Criteria Exceedances for Instantaneous Maximum Concentrations

	Station #1			Station #2			Station #3		
	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance
Cadmium	50	0	0	166	0	0	160	0	0
Copper	50	0	0	122	1	1	114	2	2
Mercury	48	0	0	166	0	0	157	0	0
Nickel	50	0	0	121	0	0	114	0	0
Zinc	50	[illegible]	0	168	1	1	156	1	1

Sampling Locations -

1: Lake Pontchartrain 9.2 miles NW of Kenner, LA (112WRD 300922090171500) 4/79-6/79. Temporary sampling station for water quality [illegible] during 1979 diversion of flood flows through the Bonnet Carre' Floodway.

2: Lake Pontchartrain at [illegible], near Manchac, LA (112WRD 301730090[illegible]) 6/74-1/83. Approximately one-third of the data [illegible] accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

3: Lake Pontchartrain at Mouth of Tangipahoa River, near Lee Landing (112WRD 301945090161500) 6/74-1/81. Approximately one-third of the data (about [illegible] samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

TABLE H-6-11 (Continued)

Trace Metals Criteria Exceedance Summary - Lake Pontchartrain

Saltwater Criteria Exceedances for 24-h Average Concentrations

	Station #10			Station #11			Station #12		
	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance
Cadmium	19	0	0	158	8	5	155	9	6
Copper	49	19	39	112	53	47	110	38	35
Mercury	49	0	0	157	6	4	150	2	1
Nickel	49	4	8	111	12	11	109	8	7
Zinc	19	0	0	155	4	3	152	6	4

Sampling Locations -

10: Lake Pontchartrain 0.9 miles North of Pointe Aux Herbes, LA (112WRD 301000089510000) 4/79-6/79. Temporary sampling station for water quality monitoring during 1979 diversion of flood flows through the Bonnet Carre' Floodway.

11: Lake Pontchartrain at Inner Harbor Navigation Canal (112WRD 300205090015500) 6/74-1/81. Approximtely one-third of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

12: Lake Pontchartrain at Mid Causeway (112WRD 301160900733300) 6/74-1/81. Approximately one-third of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

TABLE H-6-11 (Continued)

Trace Metals Criteria *Exceedance Summary* - Lake Pontchartrain

Saltwater Criteria Exceedances for 24-h Average Concentrations

	Station #7			Station #8			Station #9		
	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance
Cadmium	58	4	7	68	0	0	36	5	14
Copper	-	-	-	68	34	50	-	-	-
Mercury	9	2	22	67	4	6	3	2	67
Nickel	-	-	-	67	8	12	-	-	-
Zinc	-	-	-	67	1	1	-	-	-

Sampling Locations -

7: Pass Rigolets at US Highway 90 Bridge (21LAIORS B041708010) 3/78-4/83.

8: Lake Pontchartrain 2.2 miles NNW of Chef Menteur, LA (112WRD 300555089490300) 4/79-1/81. Approximately 70 percent of the data (about 50 samples) were *accumulated during* the 1979 diversion of flood flows throuh the Bonnet Carre' Floodway.

9: Chef Menteur Pass at US Highway 90 *Bridge* (21LAIORS S040615010) 3/78-4/83.

TABLE H-6-11 (Continued)

Trace Metals Criteria Exceedance Summary - Lake Pontchartrain

Saltwater Criteria Exceedances for 24-h Average Concentrations

	Station #4			Station #5			Station #6		
	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance
Cadmium	158	2	1	156	6	4	68	1	1
Copper	111	38	34	108	31	29	68	26	38
Mercury	155	4	3	153	8	5	67	2	3
Nickel	112	9	8	108	5	5	68	5	7
Zinc	158	6	4	155	4	3	66	2	3

Sampling Locations -

4: Lake Pontchartrain at Mouth of Techefuncta River, near Madisonville, LA (112WRD 302150090102000) 6/74-1/81. Approximately one-third of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

5: Lake Pontchartrain at Mouth of Bayou LaCombe, near LaCombe, LA (112WRD 301500089572000) 6/74-1/81. Approximately one-third of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

6: Lake Pontchartrain at West Rigolets, 5.7 miles SSE of Slidell, LA (112WRD 301015089451500) 4/79-1/81. Approximately 70 percent of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

TABLE H-6-11

Trace Metals Criteria Exceedance Summary - Lake Pontchartrain

Saltwater Criteria Exceedances for 24-h Average Concentrations

	Station #1			Station #2			Station #3		
	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance
Cadmium	50	0	0	166	3	2	160	7	4
Copper	50	33	66	122	57	47	114	35	31
Mercury	49	2	4	166	7	4	157	5	3
Nickel	50	13	26	121	7	6	114	6	5
Zinc	50	0	0	168	11	7	156	2	1

Sampling Locations -

1: Lake Pontchartrain 9.8 miles NNW of Kenner, LA (112WRD 300922090171500) 4/79-6/79. Temporary sampling station for water quality monitoring during 1979 diversion of flood flows through the Bonnet Carre' Floodway.

2: Lake Pontchartrain at Pass Manchac, near Manchac, LA (112WRD 301730090180000) 6/74-1/83. Approximately one-third of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

3: Lake Pontchartrain at Mouth of Tangipahoa River, near Lee Landing (112WRD 301945090161500) 6/74-1/81. Approximately one-third of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

[illegible]

[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	12 Station Aggregate
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] 1 -2 [illegible]-1/81	36 2 0-9 3/78-4/83	19 1 0-2 4/79-6/79	158 2 0-20 6/74-1/81	155 2 0-23 6/74-4/81	1,252 2 0-34 4/74-4/83
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	68 5 0-20 4/79-1/81	-	68 5 -19 4/79-1/81	-	49 5 2-20 4/76-6/79	112 5 0-36 1/76-1/81	110 6 2-42 5/75-1/81	9/12 5 0-80 1/76-1/82
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	67 1.1 [illegible] 4/79-1/81	9 1.1 0.0-0.2 6/78-9/82	67 1.1 0.0-1.0 4/79-1/81	3 0.7 0.0-1.5 2/81-8/82	49 0.1 -6 4/79-6/79	161 0.3 0.0-0.5 6/74-1/81	150 0.3 0.0-0.5 6/74-1/81	1,182 0.2 0.0-1.5 6/74-[illegible]/82
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	69 5 0-14 4/79-1/81	-	67 5 0-14 4/79-1/81	-	49 2 0-5 4/79-6/79	111 5 0-50 1/76-1/81	109 4 0-50 1/76-1/81	9/9 5 0-59 1/76-10/82
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	66 23 0-110 4/79-12/80	-	67 24 0-60 4/79-1/81	-	19 22 20-40 4/79-6/79	161 16 0-40 6/74-1/81	152 24 0-110 6/74-12/80	1,152 24 0-210 6/74-10/82

[illegible] 4/79-6/79. Temporary sampling station of water quality monitoring during 1979 diversion of flood flows through the Bonnet Carre' Floodway.

[illegible] 6/74-1/81. Approximately one-third of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through [illegible]

[illegible] (112KRD 301945090150??) 6/74-1/81. Approximately one-third of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through [illegible]

[illegible] 6/74-1/81. Approximately one-third of the data record (about 50 samples) were accumulated during the 1979 diversion of flood [illegible]

[illegible] 6/74-1/81. Approximately one-third of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the [illegible]

[illegible] Slidell, LA (112WRD 301015089451500) 4/79-1/81. Approximately [illegible] percent of the data (about [illegible] samples) were accumulated during the 1979 diversion of flood flows through [illegible]

[illegible] 3/78-4/83.

[illegible] (112WRD 3[illegible]55089490300) 4/79-1/81. Approximately [illegible] percent of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the [illegible]

[illegible] 3/78-4/83.

[illegible] (112WRD 301000089[illegible]000) 4/79-1/81. Temporary water sampling station for water quality monitoring during the 1979 diversion of flood flows through the [illegible]

[illegible] (112WRD 3[illegible]500) 6/74-1/81. Approximately one-third of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the [illegible]

[illegible] 6/74-1/81. Approximately one-third of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

recurrent high cadmium and copper concentrations at each sampling location. High criteria exceedance ratios are apparent for lead concentrations at the Tangipahoa River (stations 3 and 4) and Tchefuncta River (stations 5 and 6) sampling locations. Additionally, potential problems with occasionally high zinc concentrations at the Tangipahoa River at US Highway 190 (station 4) and the Tchefuncta River at US Highway 190 (station 5) are suggested.

LAKE PONTCHARTRAIN

H.6.9. Mean concentrations of five selected trace metals measured at twelve sampling locations in Lake Pontchartrain are shown in table H-6-10. Relatively high trace metal concentrations have been detected at some locations in the lake. However, the mean concentrations of all five of the trace metals listed are generally lower than those computed for the Mississippi River and freshwater tributaries to the lake.

H.6.10. The EPA maximum criteria for cadmium and mercury, and the 24-hour average criteria for cadmium and zinc, are generally less stringent (i.e., higher) for salt waters than for fresh waters. Summaries of saltwater criteria exceedances for 24-hour average and instantaneous maximum concentrations are presented in tables H-6-11 and H-6-12. As is shown in these summary tables, measured copper concentrations at each sampling location consistantly exceed the 24-hour average criteria. Additionally, lower but significant criteria exceedance ratios for measured nickel concentrations are apparent for the temporary sampling location near Kenner, Louisiana (station 1), and sampling locations near Chef Menteur Pass (station 8) and the Inner Harbor Navigation Canal (station 11). It should be noted that the short-termed sampling station near Kenner was only monitored during and immediately after diversion of flood waters through the Bonnet Carre' Floodway. The summaries for exceedances of the instantaneous maximum saltwater criteria (table

metal concentrations are acceptable for the East Pearl relative to the West Pearl River sampling location.

H.6.14. Summaries of freshwater criteria exceedances for 24-hour average and instantaneous maximum trace metal concentrations are shown on tables H-6-16 and H-6-17. These summaries suggest consistant exceedances of both the 24-hour average and maximum criteria for cadmium and lead at both sampling locations.

TABLE H-6-16

Trace Metals Criteria Exceedance Summary - Pearl River

(Freshwater Criteria Exceedances for 24-h Average Concentrations)

	West Pearl River at Hwy. 90 Bridge 1/			East Pearl River at Hwy. 90 Bridge 2/		
	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedances
Cadmium	24	24	100	51	51	100
Lead	21	21	100	48	31	65
Mercury	3	1	33	9	2	22
Nickel	-	-	-	-	-	-
Zinc	-	-	-	-	-	-

1/ West Pearl River at Highway 90 Bridge (21LA1ORS S090465020) 3/78-5/83

2/ East Pearl River at Highway 90 Bridge (21LA1ORS B090465010) 3/78-5/83

TABLE H-6-17

Trace Metals Criteria Exceedance Summary - Pearl River

(Freshwater Criteria Exceedances for Instantaneous Maximum Concentrations)

	West Pearl River at Hwy. 90 Bridge[1/]			East Pearl River at Hwy. 90 Bridge[2/]		
	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance
Cadmium	24	18	75	51	19	37
Chromium	25	0	0	53	0	0
Lead	21	11	52	48	10	21
Mercury	3	0	0	9	0	0
Nickel	-	-	-	-	-	-
Zinc	-	-	-	-	-	-

1/ West Pearl River at Highway 90 Bridge (21LA1ORS S090465020) 3/78-5/83

2/ East Pearl River at Highway 90 Bridge (21LA1ORS B090465010) 3/78-5/83

Section 7. AGRICULTURAL AND INDUSTRIAL CHEMICALS - EXISTING CONDITIONS

H.7.1 Agricultural and industrial chemicals, such as pesticides and volatile and semi-volatile organic compounds, are discharged to surface waters from several sources. Sources include: tank and barge cleaning activities, spillage during materials handling operations, runoff discharged as stormwater from industrial sites, National Pollution Discharge Elimination System (NPDES) permitted discharges, and runoff from agricultural lands. The costs of analyzing water for many of these compounds are prohibitive. Consequently, such analyses are not routinely performed and only limited data on the occurrence of these compounds in the waters of the project area are available.

MISSISSIPPI RIVER

H.7.2. Table H-7-1 lists the detection frequency for several pesticides in the Mississippi River and the percentage of observations exceeding aquatic life 24-hour average criteria. As can be noted by examining this table, the most frequently detected phenoxy herbicide and organochlorine and organophosphorus insecticides are 2,4-D, dieldrin, and diazinon, respectively. Plates H-9 through H-11 show the frequency distributions of sample collection and criteria exceedance by year for the persistant organochlorine insecticides DDT, dieldrin, and endrin. Histograms of the percentage by year of observations exceeding the stated criteria are also shown. The data, though not extensive, indicate criteria exceedance for these insecticides is decreasing. Plates H-12 and H-13 provide information on the frequency of detection, by year, for 2,4-D and diazinon. The percentage of samples, by year, in which these compounds were detected are also presented in histograms. There are no established aquatic life criteria for these two pesticides. Table H-7-2 presents residue concentrations of several pesticides detected in fish taken at various locations in the

TABLE H-7-1

FREQUENCY OF OCCURRENCE OF SELECTED PESTICIDES IN THE MISSISSIPPI RIVER*

Pesticides	Prior to 1975 Number of Samples	Prior to 1975 Frequency of Detection (%)	1975 and After Number of Samples	1975 and After Frequency of Detection (%)	All Years Number of Samples	All Years Frequency of Detection (%)	Critieria** 24-hour Average	Percentage Exceeding Critieria
Aldrin, total	45	0	92	1.1	137	0.7	-	-
Aldrin dissolved	0	-	34	2.9	34	2.9	-	-
Chlordane, total	8	0	90	1.1	98	2.0	0.004	2.0
DDE, total	45	2.2	90	0	135	0.7	0.001	0.7
DDD, total	45	13.3	90	8.9	135	10.4	0.001	10.4
DDT	45	4.4	99	28.3	144	22.6	0.001	20.8
Dieldrin, total	59	79.7	99	29.3	158	49.0	0.0019	42.1
Dieldrin, dissolved	0	-	34	44.1	34	44.1	0.0019	44.4
Endrin					156	30.5	0.0023	27.6
Heptachlor Epoxide, total	45	6.7	90	1.1	135	3.0		
- Methoxychlor, total	0	-	5	20.0	5	20.0		
- Diazinon, dissolved	0	-	34	70.6	34	70.6		
-Methy Parathion, total	8	0	89	3.4	97	3.1		
2,4-D, total	8	25.0	94	71.3	102	67.6		
2,4-D, dissolved	0	-	34	2.9	34	2.9		
2,4,5-T, total	8	25.0	86	50.0	94	47.9		
Silvex, total	8	62.5	86	16.3	94	20.2		

Source: STORET System

*Data from 27 sampling stations within the reach river mile 155 AHP to river mile 75 AHP. Overall period of record: 7/21/58 - 10/03/79.

**Freshwater criteria for 24-hour average concentration.

All concentrations are in ug/L.

TABLE H-7-2

CONCENTRATIONS OF PESTICIDES DETECTED IN FISH TISSUE - MISSISSIPPI RIVER

Parameter	River Mile 265 AHP Viscera 1/	River Mile 265 AHP Viscera 2/	River Mile 227 AHP Edible Tissue 3/	River Mile 227 AHP Viscera 3/	River Mile 200 AHP Viscera 3/	River Mile 0.5 AHP Viscera 4/	River Mile 0.5 AHP Viscera 4/
Chlordane	242	93	.393[5]	109	0.5K[6]	0	0
Dieldrin	50	0	80	1	48	0	0
Endrin	49	0	128	32	65	0	0
Hexachlorobenzene	0	0	156	35	0.5K	0	0
Toxaphene	3,530	1,358	1,336	334	1,345	0	0
Heptachlor Epoxide	38	10	28	8	0.5K	0	0
Heptachlor	0	0	0.5K	0.5K	0.5K	0	0
P,P'DDT	170	60	0.5K	0.5K	0.5K	0	0
P,P'DDD	170	40	0.5K	50	0.5K	0	0
P,P'DDE	100	30	0.5K	0.5K	98	0	0
Parathion	0	0	0.5K	0.5K	48	0	0
Methyl Parathion	41	0	0.5K	0.5K	0.5K	0	0
Guthion	0	0	0.5K	0.5K	0.5K	0	0

Source: STORET System

1/ Flathead catfish, Pylodictis olivaris collected 16 July 1975.

2/ Blue catfish, Ictalurus furcatus collected 16 July 1975.

3/ Channel catfish, Ictalurus punctatus collected at river mile 227 AHP 15 June 1977 and river mile 200 AHP 28 April 1975.

4/ Croaker, Micropogon undulatus collected 8 July 1975.

5/ Concentrations is above FDA Action Level for raw and processed fish.

6/ The character "K" following a value indicates that the actual concentration is less than the value shown. All values in ug/KG (ppb) wet weight.

Mississippi River. In some cases, these data show concentrations of pesticides several orders of magnitude greater than the maximum relative concentrations detected in the surface water. However, only one sample indicated a pesticide concentration above the corresponding Food and Drug Administration (FDA) Action Level for raw and processed fish. This sample, collected at river mile 227 AHP, had a chlordane residue concentration that exceeded the FDA Action Level of 300 parts per billion. Additional information on pesticide residues measured in fish tissue is given in table H-7-3. The indicated samples were collected from the Mississippi River at Luling, Louisiana from 1969 to 1979. As is shown in this table, fish tissue concentrations in excess of FDA action levels for total PCBs, dieldrin, and heptachlor epoxide have been observed. Table H-7-4 presents hydrocarbon concentrations measured in fish collected from the Mississippi River at Lutcher, Louisiana and table H-7-5 shows hydrocarbon and phenol concentration in fish taken at river mile 109 AHP. None of these data indicate inordinately high tissue concentrations.

H.7.3. Industrial compounds may be present in surface waters in concentrations well below levels that would damage aquatic organisms. However, some organisms are noted for their ability to bioconcentrate such compounds to levels that may be dangerous to consumers of aquatic life. Consequently, the potential effect on consumers, including man, from ingesting organisms exposed to industrial chemicals must be considered. Some of the industrial chemicals detected in the Mississippi River in the Baton Rouge to New Orleans industrial corridor are suspect carcinogens. In table H-1-3, criteria for suspect or proven carcinogens are presented as ambient water concentrations associated with a range of estimated incremental cancer risks to man. Because methods do not now exist to establish a threshold for carcinogenic effects, the EPA policy is that there is no scientific basis for estimating "safe" levels for carcinogens. Therefore, for carcinogens,

TABLE H-7-3

TISSUE CONCENTRATIONS OF SELECTED POLLUTANTS IN FISHES TAKEN FROM MISSISSIPPI RIVER AT LULING, LOUISIANA FROM 1969-1979, 1/, 2/, 3/

Species (no. samples)	Total DDT	Toxa-phene	Total PCB's	Dieldrin	Endrin	Heptachlor epoxide	C-Chlor-dane	T-Chlor-dane	C-Non-achlor	T-Non-achlor	Lindane
Freshwater drum (7)	0.616 (1.150)	0.850 (2.200)	2.327 (5.400)	0.133 (0.200)	0.079 (0.180)	0.040 (0.060)	0.090 (0.120)	0.067 (0.090)	0.023 (0.030)	0.090 (0.110)	0.017 (0.020)
Carp (9)	0.246 (0.390)	0.567 (2.500)	0.984 (4.500)	0.053 (0.130)	0.023 (0.070)	0.055 (0.400)	0.060 (0.070)	0.065 (0.070)	0.010 (0.010)	0.000 (0.000)	0.000 (0.000)
Largemouth bass (1)	0.260	0.500	0.600	0.030	0.000	0.010	0.040	0.010	0.020	0.040	0.000
Channel catfish (5)	0.540 (0.920)	0.000 (0.000)	2.350 (6.600)	0.124 (0.260)	0.138 (0.200)	0.006 (0.030)	4/ 4/	4/ 4/	4/ 4/	4/ 4/	4/ 4/
Blue catfish (3)	0.307 (0.710)	1.533 (4.600)	0.043 (0.130)	0.113 0.230	0.000 (0.000)	0.000 (0.000)	4/ 4/	4/ 4/	4/ 4/	4/ 4/	4/ 4/
Smallmouth buffalo (2)	0.000 (0.000)	3.200 (4.100)	0.850 (1.400)	0.000 (0.000)	0.000 (0.000)	4/ 4/	4/ 4/	4/ 4/	4/ 4/	4/ 4/	4/ 4/
Striped mullet (1)	0.580	4/	1.390	0.390	4/	0.000	4/	4/	4/	4/	4/

Source: US Fish and Wildlife Service.

1/ Concentrations in parts per million (ppm).

2/ Upper number represents mean concentration; lower number is maximum concentration. Underlined values exceed "action levels" set by Food and Drug Administration (see footnote 3).

3/ Food and Drug Administration "action levels" (recommended maximum safe concentrations for human consumption) are: 5 ppm for PCB's, DDT, and Toxaphene; 0.3 ppm for Heptachlor Epoxide, Dieldrin, Endrin, Chlordane, and Lindane; and 1 ppm for mercury. Action level not established for lead.

4/ Analysis not performed for pollutant indicated.

TABLE H-7-4

Hydrocarbon Residues Detected in Fish Tissue - Mississippi River 1/

Date of Collection	11-15-79	11-15-79	11-15-79	06-05-80	10-09-80	10-28-81	04-02-82
Species 2/	FWD	FWD	FWD	FWD	FWD	BLC	FWD
No. Of Individuals in Sample	1	1	1	4	4	4	3
Weight, pounds (average)	1.00	1.25	1.50	0.96	1.14	1.40	1.40
Length, inches (average)	13.50	14.00	14.00	12.44	12.88	11.88	14.08
Parts Analyzed 3/	WO	WO	WO	WO	WO	WO	WO
Heptachlor Epoxide, mg/Kg wet wgt.	0.020	0.020	0.020	-	-	-	-
Chlordane cis isomer, ug/g wet wgt.	- 4/	-	-	0.060	-	0.130	0.100
Chlordane-nonachlordane trans ismer, ug/g wet wgt.	-	-	-	-	-	0.130	-
BHC gamma isomer, ug/g wet wgt.	0.020	0.020	0.020	-	-	-	-
p,p' DDT, mg/Kg wet wgt.	.12	0.12	0.12	0.16	0.13	0.08	0.04
o,p DDT, ug/g wet wgt.	-	-	-	-		0.08	-
p,p'DDD , mg/Kg wet wgt.	0.07	0.07	0.07	0.13	0.21	0.11	0.11
p,p'DDE, mg/Kg wet wgt.	0.26	0.26	0.26	0.19	0.17	0.07	0.[illegible]
Toxaphene, mg/Kg wet wgt.	-	-	-	-	1.48	-	-
HCB, mg/Kg wet wgt.	0.17	0.17	0.17	0.02	0.09	-	0.04
Chlordene, mg/Kg	-	-	-	-	0.33	-	-
Dieldrin, mg/Kg drt wgt.	0.160	0.160	-	0.040	0.090	0.200	[illegible]
PCB-1260, mg/Kg dry wgt.	-	-	-	-	0.260	0.370	
PCB-1254, mg/Kg dry wgt.	2.2	2.2	-	0.000	0.190	-	-
Endrine, mg/Kg dry wgt.	0.020	0.020	-	-	-	0.040	0.03[illegible]

1/ Mississippi River - East Bank at Lutcher, Louisiana (21LA1ORS B0703450SO).
2/ FWD: Freshwater Drum; BLC: Blue Catfish
3/ WO: Whole Organism
4/ Not Detected

TABLE H-7-5

HYDROCARBONS AND PHENOLS DETECTED IN FISH TISSUE 1/

	Mississippi River at Mile 109 AHP		FDA Action Level
Chlorinated Insecticides			
DDE	0.06	0.04	5.0
DDD	0.04	0.05	5.0
Dieldrin	0.12	0.11	0.3
Alpha-BHC	0.03	0.3	None
Oxychlordane	0.01	ND 3/	0.3
HCB	0.02	0.02	None
Heptachlor epoxide	0.04	0.03	0.3
Alpha Chlordane	0.03	0.04	0.3
Gamma Chlordane	0.04	0.04	0.3
Trans-nonachlor	0.02	0.03	None
Cis-nonachlor	ND	0.01	None
Phenolic Compounds			
Meta & Para Chlorophenol	<7.5 2/	<7.5	None
2 - Chlorophenol	<4.0	<4.0	None
2, 6 - Dichlorophenol	<0.015	<0.015	None
2, 3 - Dichlorophenol	<0.04	<0.04	None
2, 5 - Dichlorophenol	<0.04	<0.04	None
2, 4 - Dichlorophenol	<0.03	<0.03	None
2, 4, 6 - Trichlorophenol	<0.001	<0.001	None
2, 3, 5 - Trichlorophenol	<0.004	<0.004	None
Pentachlorophenol	0.015	0.016	None
PCB 4/	0.22	0.18	None

Sources: US Fish and Wildlife Service

1/ Concentrations are parts per million. All samples were catfish. Five individuals, 12 to 14 inches long, in each sample. Collected September 1982.

2/ < indicates less than detection limit

3/ Not detected

4/ Polychlorinated biphenyls

the recommended ambient water concentration for maximum protection of human health is zero. Estimating health risks associated with human exposure to environmental pollutants requires predicting the effect of low doses over a period of a lifetime. The range of concentrations presented in table H-1-3 corresponds to incremental cancer risks of 10^{-7} to 10^{-5} over a lifetime. Essentially, an incremental cancer risk of 10^{-7} corresponds to one additional case of cancer in a population of 10 million persons, and 10^{-5} corresponds to 1 in 100,000. Specified risk concentrations are estimated using the following basic assumptions:

- o a 70 kilogram (154 pound) male as the exposed individual
- o average daily consumption of 6.5 grams (0.23 ounces) of fresh-water and estuarine fish and shellfish
- o average daily ingestion of two liters (0.53 gallons) of water

H.7.4. Table H-7-6 lists the concentrations of 11 compounds, suspected or proven organic carcinogens and noncarcinogenic volatile and semivolatile organics, detected in the Mississippi River-Baton Rouge to New Orleans industrial corridor. The following tabulation indicates the estimated incremental cancer risk over a lifetime associated with the detected in-stream concentrations of four suspected carcinogens listed in table H-7-6. These risk estimates were made on the basis of exposure to the stated compound through ingestion of contaminated water and contaminated aquatic organisms in accord with the assumptions stated above. Interestingly, concentrations of four of the compounds listed in table H-7-6 were an order of magnitude greater in the December sample than in the June samples. This difference could indicate that the highest concentrations of the volatile organics occur during months when water temperatures are coldest and the compound's volatize less. Table H-7-7 is a partial listing of organic compounds detected in a sample of raw Mississippi River water collected at New Orleans on 9 April 1981. Additional testing for these compounds should be performed to provide

TABLE H-7-6

CONCENTRATIONS OF SUSPECTED ORGANIC CARCINOGENS AND NONCARCINOGENIC VOLATILE AND SEMIVOLATILE ORGANICS DETECTED IN SURFACE WATERS

	Concentrations 1/			
ameter	River Mile 163 2/	River Mile 148 3/	River Mile 121 3/	River Mile 104 4/
-Dichloroethane	35	2	1	1
oroform	90	1	3	4
rachloroethylene	5	7	-	2
(2-ethylhexal) htalate	25	1	2	-
n-butyl Phthalate	10	-	-	2
chloroethylene	- 5/	1	-	-
hyl Palmitate	-	3	4	1
hyl Stearate	-	1	1	1
hlorobenzene	-	-	15	-
chloropropane	-	1	1	1
modichloromethane	20	-	-	-

irce: STORET System

All concentrations in ug/L.
Sample collected 14 December 1977.
Sample collected 8 June 1976.
Sample collected 9 June 1976.
Not Detected

TABLE H-7-7

PARTIAL LIST OF ORGANIC COMPOUNDS IN NEUTRAL EXTRACT OF MISSISSIPPI RIVER WATER COLLECTED 9 April 1981

---

cyclohexanone
trimethylbenzene
2-(2-ethoxyethoxy)ethanol
trimethyl phosphate
tributyl phosphate
1,2-dimethoxybenzene
benzothiazole
N,N-diethyl aniline
1,3,5-triazine-2,4,6(1H,3H,5H)-trione-1,3,5-trimethyl-bicyclo
2,2,1 heptane-1-methane sulfonic acid
2,5-dibutylthiophene
N,N,dimethyl-4-methylbenzylsulfonamide
p-nitrobenzyl chloride
dichlorobenzene isomer
dichlorobenzene isomer
hexachlorobutadiene
dinitrotoluene
o-xylene
m-xylene
p-xylene
naphthalene
methylnaphthalene isomer
C_2-napthalene isomer
C_3-napthalene isomer
2-(2-ethoxyethoxy)ethanol
biphenyl
acenaphthalene
methylbiphenyl
simazine
fluorene
methylfluorene isomer
C_2-fluorene isomer
C_3-phenanthrene isomer
fluorenone
phenanthrene
anthracene
methylphenanthrene isomer
C_2-phenanthrene isomer
C_3-phenanthrene isomer
dibenzothiophene

TABLE H-7-7 (CONTINUED)

ethyldibenzothiophene isomer
-phenanthrene isomer
3-phenanthrene isomer
ibensothiophene
ethyldibenzothiophene isomer
2 - dibenzothiophene isomer
3 - dibenzothiophene isomer
luoranthene
yrene
ethylpyrene isomer
2 - pyrene isomer
3 - pyrene isomer
utylated hydroxytoluene
riisobutylphosphate
trazine
iethylphthalate
utylbenzylphathalate
ioctylphthalate
ethyl-phenylethylphenol
hloro-diethylphenyl-methoxy-acetamide
enzathracene
hrysene
ethylchrysene isomer
2 -chrysene isomer
enzofluoranthene
enzo (e) pyrene
enzo (a) pyrene
erylene
entadecance
exadecane
eptadecane
ctadecane
onadecane
icosane

Source: University of New Orleans, Center for Bio-Organic Studies

1.8.6. The elements of the analysis are summarized as follows:

(1) Determination of degree of correlation of each parameter at each primary lake station individually with the 1-, 2-, and 3- month runoff and rainfall vaues at the river and climatic stations, and of each parameter - parameter combination, by 4- and 12- month groups.

(2) Development of optimal multiple linear regression equations for each parameter and lake station, using only selected parameter combinations.

(3) Solution of regression equations to determine estimates of monthly parameter levels relative to 25-, 50-, and 75- percent drought exceedence events at the runoff and rainfall stations.

(4) Development of monthly exceedence probability distributions of parameters, using 4- and 12- month group statistics.

(5) Determination of monthly parameter levels relative to 25-, 50-, and 75- percent exceedence drought frequency adjusted to base period (1940-1981), using results of (4) and runoff, rainfall statistics.

(6) Determination of monthly temperature and salinity probability distributions and drought frequency-related levels at four other Lake Pontchartrain stations, using results of (4) and (5), and lake station statistics.

(7) Adjustment of regression coefficients to reflect parameter levels determined in (5).

H.8.3. A list of eight key water quality parameters was selected for detailed investigation:

(1)	Nitrate and Nitrite	(NIT)
(2)	Water Temperature	(TEMP)
(3)	Suspended Solids Residue	(RSS)
(4)	Fecal Coliform	(FCOL)
(5)	Total Phosphorus	(PHOS)
(6)	Total Copper	(COP)
(7)	Turbidity	(TURB)
(8)	Salinity	(SAL)

H.8.4. These parameters were chosen for their individual importance to general water quality, and for their significance as potential contributors to or indicators of, undesirable effects such as eutrophication, thermal stress, inhibition of aquatic life movements or feeding habits, bacterial contamination, toxic effects, interference with primary productivity, and salinity tolerance. Other parameters were considered, but they usually either tended to overlap in some of the factors listed above, or were not measured with sufficient frequency or accuracy for statistical treatment, or did not represent a perceived potential problem area.

ANALYTICAL PROCEDURES

H.8.5. Tables of monthly mean observed values for each water quality parameter and river discharge, and monthly rain depth were compiled for the common record period of June 1974 to January 1981, and three later months in 1981 in which each quality parameter was measured at the Pass Manchac station only. The discharge and rainfall data was also converted to 2- and 3- month mean values for use in the correlation analysis.

Section 8. WATER QUALITY IMPACT DETERMINATIONS

H.8.1. The objective of this study was to estimate quantitatively the water quality changes that would occur by diversion of Mississippi River water into Lake Pontchartrain. It is known that tributary runoff and other point sources, such as metropolitan New Orleans storm water drainage canals, contribute significantly to constituent concentrations in the lake. Since three strategically-located stations: Mid-Causeway (MC); Mouth of Pass Manchac (PM); and Entrance of Inner Harbor Navigation Canal (IHNC) had been regularly monitored for about a 6 1/2 year period for a large number of water quality parameters, an opportunity existed to derive statistical relationships with these major influencing factors, represented as monthly discharges at three tributary stations - Amite River near Denham Springs, Tangipahoa River at Robert, and Pearl River near Bogalusa - and monthly precipitation at New Orleans International Airport.

H.8.2. Most of the study effort was devoted to the analysis of lake station data on a seasonal basis. It was important to recognize and determine the apparent effects of quantifiable hydrologic and climatic factors such as tributary discharge and precipitation, since the areas of the lake most likely to be affected by freshwater diversion from the Bonnet Carre' site are also those that are more influenced by these factors than the eastern portion , which is dominated by tidal influences. Other factors of importance in explanation of variance of water quality parameters in Lake Pontchartrain include Gulf of Mexico water movements, which alter salinity and temperature patterns, and variations in wind speed and direction over time. The scope of this analysis did not permit direct consideration of these and other potentially quantifiable factors.

TABLE H-7-13

HYDROCARBON CRITERIA EXCEEDANCE SUMMARY - GULF INTRACOASTAL WATERWAY AND MISSISSIPPI RIVER GULF OUTLET
SALTWATER CRITERIA EXCEEDANCES FOR 24-HOUR AVERAGE CONCENTRATIONS

	GIWW 1/			MRGO at Bayou Dupre 3/			MRGO at Breton Sound		
	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedances
Chlordane	119	0	0	35	0	0	38	0	0
DDD	119	0	0	35	0	0	38	1	3
DDE	119	0	0	35	0	0	38	0	0
DDT	119	0	0	35	0	0	38	3	8
Dieldrin	119	1	1	35	0	0	38	1	3
Endrin	119	0	0	35	0	0	38	0	0
Heptachlor	119	0	0	35	0	0	38	0	0
PCBs	119	1	1	35	0	0	38	2	5
Mirex	57	0	0	34	0	0	34	0	0
Methoxychlor	50	0	0	34	0	0	33	0	0

1/ Gulf Intracoastal Waterway near Paris Rd (112WRD 300024089560500)
2/ Mississippi River Gulf Outlet at Bayou Dupre (112WRD 295623089501800)
3/ Mississippi River Gulf Outlet at mile - 5.0 Breton Sound (112WRD 292730089032200)

TABLE H-7-12 (CONTINUED)

HYDROCARBON CRITERIA EXCEEDANCE SUMMARY - LAKE PONTCHARTRAIN
SALTWATER CRITERIA EXCEEDANCES FOR 24-HOUR AVERAGE CONCENTRATION

	Station #12			Aggregate		
	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance
Chlordane	148	0	0	1,115	1	0
DDD	148	0	0	1,115	1	0
DDE	148	0	0	1,115	2	0
DDT	148	2	1	1,115	9	1
Dieldrin	148	2	1	1,115	16	1
Endrin	148	0	0	1,114	0	0
Heptchlor	148	0	0	1,115	0	0
PCBs	148	0	0	1,115	8	1
Mirex	88	1	1	749	3	0
Methoxychlor	82	0	0	709	0	0

Sampling Station:

12: Lake Pontchartrain at Mid Causeway (112WRD 301116090073300) 6/74-1/81. Approximately one-third of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

TABLE H-7-12 (CONTINUED)

HYDROCARBON CRITERIA EXCEEDANCE SUMMARY - LAKE PONTCHARTRAIN
SALTWATER CRITERIA EXCEEDANCES FOR 24-HOUR AVERAGE CONCENTRATION

	Station #8			Station #10			Station #11		
	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedances
Chlordane	57	0	0	43	0	0	150	0	0
DDD	57	0	0	43	0	0	150	1	1
DDE	57	0	0	43	0	0	150	0	0
DDT	57	1	2	43	0	0	150	0	0
Dieldrin	57	1	2	43	0	0	150	3	2
Endrin	57	0	0	43	0	0	150	0	0
Heptachlor	57	0	0	43	0	0	150	0	0
PCBs	57	1	2	43	0	0	150	0	0
Mirex	57	0	0	43	0	0	91	1	1
Methoxychlor	57	0	0	43	0	0	84	0	0

8: Lake Pontchartrain 2.2 miles NNW of Chef Menteur, LA (112WRD 300555089490300) 4/79-1/81. Approximately 70 percent of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

10: Lake Pontchartrain 0.9 miles North of Pointe aux Herbes, LA (112WRD 301000089510000) 4/79-6/79. Temporary sampling station for water quality monitoring during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

11: Lake Pontchartrain at Inner Harbor Navigation Canal (112WRD 300205090015500) 6/74-1/81. Approximately one-third of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

TABLE H-7-12 (CONTINUED)

HYDROCARBON CRITERIA EXCEEDANCE SUMMARY - LAKE PONTCHARTRAIN
SALTWATER CRITERIA EXCEEDANCES FOR 24-HOUR AVERAGE CONCENTRATION

	Station #4			Station #5			Station #6		
	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedances
Chlordane	151	0	0	150	0	0	59	0	0
DDD	151	0	0	150	0	0	59	0	0
DDE	151	0	0	150	0	0	59	0	0
DDT	151	0	0	150	0	0	59	0	0
Dieldrin	151	2	1	150	1	1	59	0	0
Endrin	150	0	0	150	0	0	59	0	0
Heptachlor	151	0	0	150	0	0	59	0	0
PCBs	151	1	1	150	1	1	59	0	0
Mirex	88	1	1	87	0	0	59	0	0
Methoxychlor	81	0	0	80	0	0	59	0	0

Sampling Stations:

4: Lake Pontchartrain at Mouth of Tchefuncte River, near Madisonville, LA (112WRD 302150090102000) 6/74-1/81. Approximately one-third of the data record (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

5.: Lake Pontchartrain at Mouth of Bayou LaCombe, near LaCombe, LA (112WRD 301500089572000) 6/74-1/81. Approximately one-third of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' FLoodway.

6: Lake Pontchartrain at West Rigolets, 5.7 miles SSE of Slidell, LA (112WRD 301015089451500) 4/79-1/81. Approximately 70 percent of the data (about 50 samples) were accumulated during their 1979 diversion of flood flows through the Bonnet Carre' Floodway.

TABLE H-7-12

HYDROCARBON CRITERIA EXCEEDANCE SUMMARY - LAKE PONTCHARTRAIN
SALTWATER CRITERIA EXCEEDANCES FOR 24-HOUR AVERAGE CONCENTRATION

	Station #1			Station #2			Station #3		
	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedance	No. of Samples	No. of Exceedances	Percent Exceedances
Chlordane	44	0	0	164	1	1	149	0	0
DDD	44	0	0	164	0	0	149	0	0
DDE	44	0	0	164	0	0	149	2	1
DDT	44	2	5	164	1	1	149	3	2
Dieldrin	44	5	11	164	1	1	149	3	2
Endrin	44	0	0	164	0	0	149	0	0
Heptachlor	44	0	0	164	0	0	149	0	0
PCB's	44	1	2	164	2	1	149	2	1
Mirex	44	0	0	101	1	1	91	0	0
Methoxchlor	44	0	0	94	0	0	85	0	0

Sampling Stations:

1: Lake Pontchartrain 9.8 miles NNWW of Kenner, La (112WRD 300922090171500) 4/79-6/79. Temporary sampling station of water quality monitoring during 1979 diversion of flood flows through the Bonnet Carre' Floodway.

2: Lake Pontchartrain at Pass Manchac, near Manchac, LA (112WRD 301730090180000) 6/74-1/83. Approximately one-third of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

3: Lake Pontchartrain to Mouth of Tangipahoa River, near Lee Landing (112WRD 30194509061500) 6/74-1/81. Approximately one-third of the data (about 50 samples) were accumulated during the 1979 diversion of flood flows through the Bonnet Carre' Floodway.

H.7.7. Examination of data for water samples collected from Lake Pontchartrain suggests that chlorinated hydrocarbons are infrequently detected. A criteria exceedance summary, based on analyses of water samples collected from June 1974 through January 1983 at various locations in the Lake, is shown in table H-7-12. In aggregate, over 1,100 water samples from the Lake were analyzed for most of the chlorinated hydrocarbons listed in table H-7-12. Generally, one percent or less of the samples indicated hydrocarbon concentrations greater than the EPA criteria.

H.7.8. Data from analyses of water samples collected from the GIWW and MRGO are generally similar to those for Lake Pontchartrain in that the frequency of detection of most chlorinated hydrocarbons is low. A criteria exceedance summary for these areas is shown on table H-7-13.

TABLE H-7-11

HYDROCARBON RESIDUES DETECTED IN FISH TISSUE - TANGIPAHOA RIVER

Date of Collection	2-23-79	6-27-79	1-11-80	1-11-80	1-15-81	11-2-81	7-19-82
Species	BRH	SPB	BTH	BTH	BLC	CHC	
No. of Individuals in Sample	3	7	1	1	4	4	3
Weight, pounds (average)	1.73	0.30	1.80	2.00	0.46	0.86	0.67
Length, inches (average)	15.17	7.60	16.25	16.50	11.88	13.90	12.50
Parts Analyzed	WO	WO	WO	WO	WO	WO	WO
PCP, mg/Kg wet wgt	-	-	-	-	0.010	-	-
Chlordane cis isomer, ug/g wet. wgt.	-	-	0.010	0.010	-	0.000	0.030
Chlordane - NONAchlordane trans isomer ug/g wt wgt.	-	-	-	0.000	-		
Alpha BHC mg/Kg wet wgt.	-	-	0.040	0.040	-	-	-
P, p' DDT, mg/Kt wet wgt.	0.02	-	-	-	-	-	0.01
p, p' DDD, mg/Kg wet mgt.	0.06	-	-	-	-	-	-
p, p' DDE mg/Kg wet mgt.	0.03	0.02	0.15	0.15	0.01	0.003	0.01
Chlordene, Kg	0.23	-	-	0.10	-	-	-
Mirex, ug/g wet. mgt.	-	-	-	-	-	-	0.010
Dieldrin, mg/Kg dry wgt.	-	-	0.010	0.010	-	0.000	-
PCB - 1260, mg/Kg dry wgt.	-	-	0.210	0.210	-	-	-
PCB - 1254, mg/Kg dry wgt.	-	-	-	-	-	0.070	-
Endrin, ug/Kg dry wgt.	-	-	0.010	0.010	-	-	-

Tangipahoa River at US Highway 190 Bridge (21LAIORS B042180030)

BRH: Black Rehorse, SPB: Spotted Bass; BTH: Blacktail Redhorse; BLC: Blue Catfish; CHC: Channel Catfish

WO: Whole Organism

TABLE H-7-10

HYDROCARBON RESIDUES DETECTED IN FISH TISSUE - TANGIPAHOA RIVER

Date of Collection	06-28-79	10-19-79	10-19-79	07-19-79
Species	LMB	CHC	CHC	CHC
No. of Individuals in Sample	3	1	1	3
Weight, pounds (average)	0.57	1.90	2.60	0.56
Length, inches (average)	10.21	17.50	20.38	11.67
Parts Analyzed	WO	WO	WO	WO
Chlordane cis isomer, ug/g wet wgt.	-	-	-	0.030
p,p' DDT, mg/Kg wet wgt	-	0.02	0.02	-
p,p' DDE, mg/Kg wet wgt.	0.03	0.04	0.04	0.02
Mirex, ug/g wet wgt.	0.050	-	-	0.020
Pentachloroanisole, mg/Kg wet wgt.	-	-	-	0.010
PCB - 1254, mg/Kg dry wgt.	-	0.250	0.250	-

Tangipahoa River at Hwy 38 Bridge (21LA1ORS B042180010)

LMB: Largemouth Bass; CHC; Channel Catfish

WO: Whole Organism

TABLE H-7-9

HYDROCARBON RESIDUES DETECTED IN FISH TISSUE - PASS MANCHAC 1/

Date of Collection	01-31-79	06-14-79	11-14-79	11-14-79	06-18-80	10-28-80
Species 2/	BLC	LMB	LMB	LMB	LMB	LMB
No. of Individuals in Sample	4	2	1	1	3	5
Weight, pounds (average)	0.77	1.50	1.12	2.00	0.85	0.75
Length, inches (average)	13.13	14.25	13.25	15.75	12.13	11.38
Parts Analyzed 3/	WO	WO	WO	WO	WO	WO
Chlordane cis isomer, ug/g wet wgt.	- 4/	-	-	-	0.000	-
Chlordane - nonochlordane trans isomer, ug/g wet wgt.	-	-	-	-	0.010	-
p,p' DDT, mg/Kg wet wgt.	-	-	0.02	0.02	0.01	-
p,p' DDD, mg/Kg wet wgt.	-	0.05	0.02	0.02	0.01	-
p,p' DDE, mg/Kg wet wgt	-	0.03	0.04	0.04	0.02	0.02
Chlordene, mg/Kg	0.26	0.15	-	-	-	-
Dieldrin, mg./Kg dry wgt.	-	-	0.010	0.010	0.000	-
PCB - 1254, mg/Kg dry wgt	-	-	0.330	0.330	0.050	-

1/ Pass Manchac East of US Hwy 51 (21LA10RS B041705010)

2/ BLC: Blue Catfish: LMB: Largemouth Bass

3/ WO: Whole Organism

4/ Not Detected

TABLE H-7-8

HYDROCARBON CRITERIA EXCEEDANCE SUMMARY-LAKE MAUREPAS

FRESHWATER CRITERIA EXCEEDANCES FOR 24-HOUR AVERAGE CONCENTRATIONS

	No. of Samples	No. of Exceedances	Percent of Exceedances
Chlordane	134	0	0
DDD	133	0	0
DDE	133	0	0
DDT	133	0	0
Dieldrin	133	2	2
Endrin	133	1	1
Heptachlor	133	0	0
PCBs	133	0	0
Mirex	94	0	0
Methoxychlor	87	0	0

1/ Middle of Lake Maurepas near Manchac, LA (112WRD 301500090300000)

some insight into the frequency of their occurrence in the waters of the project area.

Compound	Detected Concentration	Estimated Incremental Cancer Risk	Detected Concentration	Estimated Incremental Cancer Risk
Chloroform	90 ug/L	1 in 2,111	1 ug/L	1 in 190,000
1,2,dichloroethane	35 ug/L	1 in 2,686	1 ug/L	1 in 940,000
Tetrachloroethylene	7 ug/L	1 in 114,286	1 ug/L	1 in 800,000
Bromodichloromethane	20 ug/L	1 in 9,500	-	

LAKE MAUREPAS/PASS MANCHAC AND TANGIPAHOA RIVER

H.7.5. Evaluation of data for water samples collected from Lake Maurepas during the period April 1975 through January 1981 indicates that most pesticides for which analyses are performed are infrequently detected. Chlorinated hydrocarbons, when detected in water samples, are normally measured in the parts per trillion (ng/L) range. A criteria exceedance summary, based on analyses of water samples collected from Lake Maurepas, for selected chlorinated hydrocarbons is shown in table H-7-8.

H.7.6. Long-term data for pesticide concentrations in water were not available for Pass Manchac or the Tangipahoa or Tchefuncta Rivers. However, data on hydrocarbon residues detected in fishes collected from Pass Manchac are shown in table H-7-9. Similar data for samples collected from two Tangipahoa River locations are shown in tables H-7-10 and H-7-11. None of the tissue concentrations shown in these tables exceed FDA action levels.

(8) Estimations of no-discharge ambient parameter levels at the three primary lake stations during the 1979 Bonnet Carre' Spillway discharge period, using regression coefficients determined in (2) and (7).

(9) Comparative analysis of observed and estimated ambient lake parameter levels during the 1979 Bonnet Carre' discharge period with observed parameter levels and discharges in the spillway.

(10) Application of equations derived in (9) to normal and extreme-condition Mississippi River diversion water and Lake Pontchartrain station parameter levels to predict effects of proposed freshwater diversion structure operation.

(11) Preparation of maps showing isoline contours of ambient and with-project parameter levels in Lake Pontchartrain.

H.8.7. A comparative review of period-of-record monthly-mean parameter levels at the primary stations (MC, PM, and IHNC) led to the decision to divide the data into three four-month groups: Jan-Apr (Group 1); May-Aug (Group 2); and Sep-Dec (Group 3). This seasonal grouping most nearly achieved the objective of having each group represent the smallest and/or most uniformly varying range of values. The only three parameters whose variance characteristics were not well-represented by this arrangement were temperature, total phosphorus, and salinity. Preferred groupings for these parameters were: temperature (Oct-Feb; Mar-May; Jun-Sep); phosphorus (Dec-Jan; Feb-Apr; May-Nov); and salinity (Feb-Jul; Aug-Sep; Oct-Jan). It would have been awkward and impractical to have used different arrangements for these parameters, however, because of the need for uniformity in conducting most elements of the analysis. The use of multi-month data sets was necessary in this case because the brief (6 1/2 year) period of record was insufficient for

statistical reliability of one-month data sets.* A 12-month data set was also compiled for use in portions of the analysis.

H.8.8. A SAS computer procedure, CORR, was used to determine degrees of correlation between paired combinations of: water quality parameters, as dependent variables; and runoff, rainfall and water quality parameters, as independent variables. Each variable pair was analyzed using both arithmetic and logarithmic forms of the variable (four sets per pair). Those variable-transform combinations having the highest correlation coefficients (R) were designated for possible use in the multiple regression analysis.

H.8.9. Those water quality parameter pairs having significant degrees of correlation, and that were believed to possess a true dependency or interdependency were retained for multiple regression analysis, along with the best-fit combinations of each parameter with the runoff and rainfall variables. Since water quality responses to hydrologic events are not necessarily immediate, 2- and 3- month averages of the discharge and rainfall station values were included as independent variables in the correlation analysis. Thus, effective lag times of 0 to 2 months could be considered in each case. Table H-8-1 is an example of the CORR procedure output for one of the lake station 4-month groups.

H.8.10. Another SAS procedure, STEPWISE, determined the best-correlating combination of each water quality parameter as a dependent variable with combinations of 1 to n independent variables, i.e. one

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*The months that were presumed to be affected by Bonnet Carre' Spillway diversions in 1975 and 1979 were not included in data sets, because of their obvious bias.

TABLE H-8-1

EXAMPLE OF CORR PROCEDURE OUTPUT

LAKE PONTCHARTRAIN @ MID CAUSEWAY
MONTHLY MEANS 1974-1981
GROUP=3

12:13 THURSDAY, APRIL 28, 1983

VARIABLE	N	MEAN	STD DEV	SUM	MINIMUM	MAXIMUM
SLNTY	26	3.40000	1.47919	88.4000	1.20000	6.40000
TEMP	22	18.50000	5.84930	407.0000	8.00000	30.00000
TURB	25	6.24000	5.25420	156.0000	0	25.00000
SUS_RES	25	11.56000	11.88865	289.0000	0	45.00000
NO2_NO3	25	0.07640	0.09291	1.9100	0	0.38000
PHOS	26	0.11923	0.27008	3.1000	0.02000	1.28000
CU	18	4.72222	4.23994	85.0000	2.00000	20.00000
FCOL	25	8.36000	11.21710	209.0000	0	46.00000
LOG_SAL	26	1.11546	0.49914	29.0018	0.18232	1.85630
LOG_TEMP	22	2.86709	0.33360	63.0760	2.07944	3.40120
LOG_TURB	21	1.87910	0.45963	39.4612	1.60944	3.21888
LOG_SRES	23	2.20343	0.79584	50.6788	1.09861	3.80666
LOG_NIT	22	-2.98861	1.13466	-65.7495	-4.60517	-0.96758
LOG_PHOS	26	-2.93201	0.96133	-76.2323	-3.91202	0.24686
LOG_CU	18	1.32603	0.63075	23.8685	0.69315	2.99573
LOG_FCOL	24	1.70304	0.89208	40.8729	0	3.82864

LAKE PONTCHARTRAIN @ MID CAUSEWAY
MONTHLY MEANS 1974-1981
GROUP=3

12:13 THURSDAY, APRIL 28, 1983

CORRELATION COEFFICIENTS / PROB > |R| UNDER H0:RHO=0 / NUMBER OF OBSERVATIONS

	SLNTY	TEMP	TURB	SUS_RES	NO2_NO3	PHOS	CU	FCOL	LOG_SAL	LOG_TEMP	LOG_TURB	LOG_SRES	LOG_NIT
SLNTY	1.00000	-0.16783	-0.10466	0.06558	0.15644	-0.30598	0.07563	0.14275	0.97781	-0.18758	-0.01884	0.04151	[illegible]
	0.0000	0.4553	0.6186	0.7555	0.4552	0.1285	0.7655	0.4960	0.0001	0.4032	0.9354	0.8508	[illegible]
	26	22	25	25	25	26	18	25	26	22	21	23	[illegible]
TEMP	-0.16783	1.00000	-0.09245	0.01335	0.23909	-0.10816	0.13002	-0.18369	-0.11531	0.98181	0.04558	-0.02361	0.19519
	0.4553	0.0000	0.6902	0.9542	0.2966	0.6319	0.6578	0.4254	0.6094	0.0001	0.8530	0.9191	0.4376
	22	22	21	21	21	22	14	21	22	22	19	21	18
TURB	-0.10466	-0.09245	1.00000	0.74275	0.46019	0.41547	0.27415	-0.06631	-0.07569	-0.11533	[illegible]	0.67913	[illegible]
	0.6186	0.6902	0.0000	0.0001	0.0206	0.0389	0.2709	0.7582	0.7191	0.6186	0.0001	[illegible]	[illegible]
	25	21	25	24	25	25	18	24	25	21	21	[illegible]	[illegible]
SUS_RES	0.06558	0.01335	0.74275	1.00000	0.62699	0.06797	0.32613	[illegible]	0.09970	-0.07836	0.77180	[illegible]	[illegible]
	0.7555	0.9542	0.0001	0.0000	0.0011	0.7468	0.8014	[illegible]	0.6354	0.7357	0.0001	[illegible]	[illegible]
	25	21	24	25	24	25	17	25	25	21	[illegible]	[illegible]	[illegible]

combination for each independent variable in the data set. The criteria for selection of the single best multiple regression equation was as follows:

(1) Identify the variable combination having the least mean square error;

(2) Locate the combination, if any, having the least number of variables whose mean square error is no more than 1 percent greater than the previously identified combination;

(3) If the tentatively selected combination contains more independent variables than 1/3 times the degrees of freedom (number of observations minus total number of variables), apply the first two criteria only to the remaining combinations meeting criterion (3).

(4) If the combination meeting the first three criteria has an R^2 value (determination coefficient) lower than the PROB>F value (probability of no correlation) it should be rejected, and no variable combination from that group would be selected.

(5) If criterion (4) applies, apply criteria (1) through (4) to the 12-month data set for the dependent variable. If none of these combinations meets the criteria, no equation will be used.

The regression coefficients of the selected equations were tabulated in matrix form for each station and group. An example is shown in Table H-8-2.

H.8.11. Using the tables of monthly 25-, 50-, and 75- percent exceedence stream discharge and rainfall values (1-, 2-, and 3- month means) derived from the base period of record for each of the stations,

TABLE H-8-2

COMPUTED REGRESSION COEFFICIENTS FROM STEPWISE PROCEDURE

LAKE PONTCHARTRAIN @ IHNC GROUP 1
JAN-APR (1974-1981)

(VARIABLE) DEPENDENT	INDEPENDENT INTERCEPT	AR1 (Amite	AR2 River	AR3 Discharge)	TR1 (Tangipahoa	TR2 River	TR3 Discharge)	PR1 (Pearl	PR2 River	PR3 Discharge)	RF1 (New	RF2 Orleans	RF3 Rainfall)	SAL	TEMP	TURB	RSS	NIT	PHOS	COP	FCOL
SALINITY L	-2.100 R^2 = .34					+1.58 (A)	-3.100 (L)														
TEMPERATURE L	.510 R^2 = .70	+.919 (L)			-.39 (A)			-.327 (L)		+.974 (L)				-.090 (L)							
TEMPERATURE A	-9.74 R^2 = .74						(L) -18.47	(L) +1.90	(L) -12.70	(L) +15.17											
TURBIDITY L	2.717 R^2 = .81						+.339 (L)				-.227 (L)		+.503 (L)	-.352 (A)		+.0033 (A)					+.0003 (A)
TURBIDITY A	10.66 R^2 = .91						(L) +17.67				(L) -10.12	(L) +12.69					(A) +.14				(A) +.016
SUSPENDED RESIDUE L	4.529 R^2 = .63	-.474 (L)	-.951 (A)				+3.074 (L)						+1.367 (L)	-.705 (A)							
NITRATE + NITRITE A	-.177 R^2 = .74			(L) -.0513							(A) +.0189		(A) -.0381			(L) +.1800	(A) -.00056				(A) -.00005
PHOSPHORUS, TOTAL L	-3.371 R^2 = .68											-.740 (L)	+1.207 (L)				+.466 (L)	+.683 (L)			
COPPER, TOTAL L	.564 R^2 = .28								+2.120 (L)	-1.844 (L)											
COPPER, TOTAL A	7.61 R^2 = .05																(L) -.47				
FECAL COLIFORM L	-3.004 R^2 = .61				+1.996 (L)		-2.409 (L)									+1.888 (L)					
FECAL COLIFORM A	369.43 R^2 = .78				(L) +393.41		(L) -1100.2				(L) +300.49		(L) 747.64			(A) +39.55	(L) -192.67				

Notes: (L) and (A) denote logarithmic and arithmetic forms of the variables. Where two equations are shown for a dependent variable, the one having the highest R^2 value was selected.

the regression equations were solved by substitution of the appropriate independent variable values. The resultant water quality parameter values were those predicted to occur during 75-, 50-, and 25- percent drought periods, respectively.

H.8.12. As expected, those parameters whose correlation was relatively poor (lower R^2) tended to have less reasonable predicted values. In some cases, variables expected to increase or decrease in value with respect to runoff-rainfall frequency did not do so. But, perhaps the greatest problem was that obvious discontinuities and/or other inconsistencies existed between the 4-month groups for most parameters. Obviously, some modifications were needed to make the regression equations more reflective of historically observed parameter values and month-to-month changes, especially between groups.

H.8.13. A numerical procedure was developed to convert each parameter's statistics for the 4- and 12-month groups (mean, standard deviation, and skewness) to statistics representing individual months that would both retain the relative magnitudes of the observed monthly values, and provide for more gradual changes of the statistics (and resultant parameter values) from month-to-month throughout the year. Group determination coefficients were converted to monthly values by this procedure. The procedure and copies of pertinent calculations are on file at the New Orleans District Office for review.

H.8.14. Application of the monthly statistics to a Pearson Type 3 probability distribution gave parameter values corresponding to exceedence probabilities of 10-, 25-, 50-, 75-, and 90 percent. These values are tabulated, by lake station, on Tables H-8-3, H-8-4, and H-8-5. Since the original statistics were obtained from data representing about 6 1/2 years of record, it was recognized that appropriate

TABLE [illegible]

ESTIMATED EXCEEDENCE PROBABILITY DISTRIBUTIONS OF WATER QUALITY PARAMETERS

LAKE PONTCHARTRAIN [illegible] MID-CAUSEWAY

Exceed. Prob.	Param.	R^2 [illegible]	R^2 1st Mo.	R^2 2nd Mo.	R^2 3rd Mo.	R^2 4th Mo.	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
[illegible]	SAL						[illegible]	[illegible]	3.6	3.2	2.8	3.[illegible]	[illegible]	3.6	6.3	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.67	3.4 (3.9)	[illegible]	2.9 (3.0)	2.[illegible] ([illegible])	2.1 (2.4)	2.2 (2.5)	2.2 (2.4)	[illegible]	[illegible] (3.9)	4.2 ([illegible])	[illegible]	[illegible] (4.7)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.2 ([illegible])	2.7 ([illegible])	2.3 (2.5)	1.9 (2.[illegible])	1.5 ([illegible])	1.5 ([illegible])	1.4 ([illegible])	[illegible]	[illegible] (3.2)	3.3 ([illegible])	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.1 (2.[illegible])	1.8 (2.0)	1.4 (1.6)	1.0 ([illegible])	1.0 (1.2)	[illegible] (1.2)	[illegible]	1.8 ([illegible])	2.3 ([illegible])	[illegible]	[illegible] (3.6)
[illegible]							[illegible]	1.6	1.3	0.9	[illegible]	0.7	[illegible]	[illegible]	1.2	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]						[illegible]	[illegible]	21.3	24.3	26.8	27.[illegible]	29.3	[illegible]	29.3	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	16.3	19.6	23.[illegible]	26.[illegible]	[illegible]	29.1	[illegible]	[illegible]	23.3	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.29	[illegible]	[illegible]	17.8	21.3	24.8	27.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	.29	[illegible]	[illegible]	.34	[illegible]	[illegible]	12.2	16.[illegible]	19.6	23.2	26.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]							8.3	[illegible]	14.3	17.9	21.5	25.8	27.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]						26	33	[illegible]	43	43	35	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.92	17 ([illegible])	22 (19)	2[illegible] (23)	20 (26)	26 (21)	19 (14)	[illegible] (7)	[illegible] (6)	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	.44	[illegible]	.96	.92	[illegible]	[illegible]	12 (9)	1[illegible] (12)	18 (15)	14 (12)	8 (7)	[illegible]	2 ([illegible])	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	.62	[illegible]	[illegible]	.34	.72	3 ([illegible])	5 (1)	8 (1)	10 (1)	8 (7)	3 (2)	0 ([illegible])	[illegible]	[illegible]	3 (2)	[illegible]	[illegible]
[illegible]								[illegible]	4	6	5	2	0	[illegible]			[illegible]	[illegible]
[illegible]	[illegible]						[illegible]	79	88	73	60	38	[illegible]	23	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] (34)	55 (47)	52 (48)	[illegible] (60)	27 (21)	22 (18)	17 (13)	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27 ([illegible])	27 (19)	32 ([illegible])	33 (31)	17 (15)	16 (14)	[illegible] (10)	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3 ([illegible])	[illegible]	11 ([illegible])	19 ([illegible])	2[illegible] (21)	9 (9)	7 (7)	[illegible]	[illegible]	[illegible] (5)	[illegible]	7 (5)
[illegible]							[illegible]	[illegible]	[illegible]	[illegible]	16	3	2	2	2	2	[illegible]	1
[illegible]	[illegible]						[illegible]	[illegible]	[illegible]	.39	.29	.25	.19	[illegible]	[illegible]	[illegible]	[illegible]	.22
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.86	.23 ([illegible])	.2[illegible] (.22)	.30 ([illegible])	.22 (.13)	.2[illegible] (.13)	.17 ([illegible])	[illegible] (.08)	.13 (.09)	[illegible]	[illegible]	[illegible]	.13 (.07
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.73	[illegible]	[illegible]	[illegible]	.10 (.06)	[illegible]	[illegible]	.09 ([illegible])	.07 (.05)	.08 (.07)	[illegible]	[illegible]	[illegible]	.0[illegible] (.01
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.73	[illegible]	[illegible] (.02)	[illegible]	.00 (.04)	[illegible]	[illegible]	[illegible]	.02 (.01)	.04 ([illegible])	[illegible]	[illegible]	[illegible]	.00 (.00
[illegible]							[illegible]	.00	.00	[illegible]	[illegible]	[illegible]	.00	.00	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]						.26	[illegible]	.14	.11	[illegible]	[illegible]	.14	.18	.30	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.42	[illegible]	[illegible]	.12 ([illegible])	[illegible]	.09 ([illegible])	[illegible]	[illegible] (.06)	.10 (.07)	.11 ([illegible])	.17 ([illegible])	[illegible]	.24 ([illegible])	[illegible] (.06
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.49	[illegible]	[illegible] (.09)	[illegible]	.06 ([illegible])	.06 (.06)	[illegible]	[illegible]	.07 (.06)	.06 (.05)	[illegible]	[illegible]	[illegible]	.09 ([illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.03 (.02)	.05 (.05)	.05 ([illegible])	.04 ([illegible])	.03 ([illegible])	.01 ([illegible])	[illegible]	[illegible]	[illegible]	.02 ([illegible]
[illegible]							[illegible]	[illegible]	.00	[illegible]	[illegible]	.03	[illegible]	.00	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]						[illegible]	[illegible]	7.9	8.3	[illegible]	6.3	5.6	6.3	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6.2 ([illegible])	[illegible] (3.5)	[illegible]	[illegible] (5.5)	5.4 (4.7)	[illegible]	4.8 ([illegible])	6.8 ([illegible])	[illegible]	[illegible] (5.9)	[illegible] (3.3)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.97	[illegible]	3.4 ([illegible])	[illegible] (3.3)	[illegible] (4.1)	[illegible] (4.6)	4.4 ([illegible])	[illegible]	3.2 (2.8)	[illegible]	[illegible]	[illegible]	3.[illegible] (2.2)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.2 (3.1)	[illegible] (3.3)	3.3 ([illegible])	[illegible]	2.6 (2.7)	[illegible]	[illegible]	[illegible]	2.2 ([illegible])	1.[illegible] (0.7)
[illegible]							[illegible]	[illegible]	[illegible]	1.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.6	[illegible]	[illegible]
[illegible]	[illegible]						[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	114	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	.33	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	44 (39)	93 ([illegible])	202 ([illegible])	[illegible] (179)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] (9)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9 ([illegible])	[illegible] (17)	0 ([illegible])	12 ([illegible])	[illegible] (94)	74 ([illegible])	23 ([illegible])	[illegible]	[illegible]	[illegible] (7)
[illegible]	[illegible]	.37	.33	[illegible]	[illegible]		[illegible]	[illegible]	0 (12)	0 (10)	0 ([illegible])	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] (3)	[illegible]
[illegible]							[illegible]	[illegible]	0	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5

[illegible] Left values refer to redistributing [illegible] into monthly statistics (1974-1981).
Right values refer to adjusting [illegible] runoff and rainfall regime (1946-19[illegible]), and determination coefficients (R^2).

TABLE H-8-4

ESTIMATED EXCEEDENCE PROBABILITY DISTRIBUTIONS OF WATER QUALITY PARAMETERS

Lake Pontchartrain 3 Pass Manchac

[illegible]	Parameter	R^2					JAN		FEB		MAR		APR		MAY		JUN	
	SAL						[illegible]		[illegible]		1.5		1.5		[illegible]		1.4	
	Jan-Apr	[illegible]	[illegible]	[illegible]	[illegible]	.31	[illegible]	([illegible])	1.[illegible]	([illegible].7)	[illegible]	(0.6)	1.[illegible]	(0.6)	[illegible]	(1.1)	0.9	(1.0)
	May-Aug	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.9	([illegible])	0.5	([illegible])	[illegible]	(0.6)	[illegible]	(0.6)	0.6	([illegible])	0.5	(0.6)
	Sep-Dec	[illegible]	[illegible]	[illegible]	.17	[illegible]	.6	(1.[illegible])	0.2	([illegible])	0.3	(0.6)	0.3	([illegible])	0.4	([illegible])	0.2	(0.3)
							[illegible]		0.0		0.2		0.1		0.2		0.0	
	[illegible]						16.9		18.5		21.9		25.2		27.5		28.5	
	Jan-Apr	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	14.7		16.5		20.2		23.7		26.4		28.0	
	May-Aug	[illegible]	.72	.66	[illegible]	.54	12.1		14.3		18.3		22.0		25.2		27.5	
	Sep-Dec	[illegible]	[illegible]	[illegible]	[illegible]	.43	9.6		12.1		16.3		20.3		23.[illegible]		26.8	
							7.5		10.1		14.5		16.8		22.6		26.2	
	[illegible]						48		56		53		51		41		39	
	Jan-Apr	.67	[illegible]	.61	.5	.55	37	(26)	44	(36)	40	(32)	37	(25)	29	(18)	28	(16)
	May-Aug	[illegible]	[illegible]	.29	.21	.24	27	(23)	33	(28)	27	(23)	23	(18)	15	(14)	17	(13)
	Sep-Dec	.21	.09	.17	.25	.33	19	(19)	23	(20)	18	(15)	12	(11)	8	(11)	8	(11)
							15		17		10		4		2		2	
	[illegible]						[illegible]		147		121		79		59		56	
	Jan-Apr	[illegible]	.43	[illegible]	.67	.43	78	([illegible])	95	(71)	92	(58)	48	(24)	34	(12)	36	(17)
	May-Aug	[illegible]	.5	.10	.04	.00	48	(39)	53	(39)	29	(18)	20	(12)	13	(9)	18	(15)
	Sep-Dec	[illegible]	[illegible]	.05	.22	.29	25	(25)	18	(14)	[illegible]	(6)	0	(7)	[illegible]	(7)	6	(14)
90							9		[illegible]		0		0		0		0	
	[illegible]						.29		.33		.34		.31		.26		.25	
	Jan-Apr	.7[illegible]	.65	.72	.72	.66	.25	.25	.30	.30	.31	.31	.27	.27	.20	.15	.19	.14
	May-Aug	.62	.64	.63	.62	.66	.20	.22	.27	.28	.28	.29	.22	.24	.14	.12	.13	.11
	Sep-Dec	.63	[illegible]	.62	.64	.65	.15	.19	.23	.25	.24	.26	.17	.21	.09	.09	.08	.08
90							.11		.18		.19		.13		.05		.05	
	[illegible]						.59		.54		.43		.38		.26		.16	
	Jan-Apr	.77	.74	.69	.65	.60	.29	.17	.29	.17	.21	.10	.20	.09	.17	.10	.12	.09
	May-Aug	.41	.46	.31	.34	.51	.10	.07	.11	.07	.05	.03	.06	.03	.08	.07	.09	.08
	Sep-Dec	[illegible]	.32	[illegible]	[illegible]	.60	.03	.02	.03	.02	.00	.01	.00	.01	.03	.05	.05	.07
							.01		.01		.00		.00		.00		.03	
	[illegible]						9.2		10.4		10.4		10.3		8.7		8.2	
	Jan-Apr	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6.5	3.9	7.9	5.5	8.1	5.8	8.2	6.1	7.2	5.5	6.5	5.0
	May-Aug	[illegible]	.42	[illegible]	[illegible]	.69	3.9	3.9	5.5	5.5	5.8	5.8	6.1	6.1	5.5	4.8	4.8	4.2
	Sep-Dec	.92	[illegible]	[illegible]	.92	.73	1.9	3.9	3.6	5.5	3.9	5.8	4.3	6.1	3.9	4.1	3.3	3.4
90							0.5		2.2		2.6		3.0		2.6		2.0	
	[illegible]						676		922		702		662		327		272	
	Jan-Apr	.73	.66	.80	.80	.66	372	230	445	287	245	147	223	110	128	39	124	46
	May-Aug	[illegible]	.52	.47	.43	.38	106	82	55	42	0	0	0	0	0	0	3	3
	Sep-Dec	[illegible]	.36	.43	.47	.52	[illegible]	26	0	6	0	0	0	0	0	0	0	2
							0		0		0		0		0		0	

[illegible]	Parameter	JUL		AUG		SEP		OCT		NOV		DEC	
	SAL	1.7		1.8		2.6		2.9		3.2		2.6	
	Jan-Apr	1.1	(1.2)	1.2	(1.2)	1.9	([illegible].7)	2.0	(1.7)	2.3	(1.9)	1.9	(1.6)
	May-Aug	0.6	(0.8)	0.7	(0.9)	1.[illegible]	(1.5)	1.2	(1.5)	1.5	(1.8)	1.2	(1.5)
	Sep-Dec	0.3	(0.4)	0.4	(0.7)	0.7	(1.3)	0.6	(1.4)	0.9	(1.7)	0.7	(1.5)
		0.1		0.2		[illegible]		.2		[illegible]		[illegible]	
	[illegible]	29.6		30.7		29.2		25.4		21.2		18.5	
	Jan-Apr	29.3		29.7		27.3		23.2		19.[illegible]		15.7	
	May-Aug	28.8		28.5		25.[illegible]		20.9		16.[illegible]		12.7	
	Sep-Dec	28.2		27.2		23.2		18.6		13.5		10.[illegible]	
		27.6		26.0		21.5		16.7		11.5		7.8	
	[illegible]	40		36		27		20		22		35	
	Jan-Apr	29	(18)	27	([illegible])	20	(12)	16	(11)	18	(13)	28	(22)
	May-Aug	19	(16)	17	(14)	14	(12)	11	(10)	13	(12)	22	(20)
	Sep-Dec	11	(14)	10	(13)	[illegible]	(11)	8	(9)	10	(11)	16	(18)
		5		4		5		[illegible]		7		12	
	[illegible]	52		42		31		29		39		72	
	Jan-Apr	37	(21)	30	(17)	24	(15)	23	(14)	30	([illegible])	56	(38)
	May-Aug	23	(20)	19	(17)	17	(15)	16	(14)	20	(17)	40	(36)
	Sep-Dec	13	(20)	11	(17)	11	(15)	9	(14)	10	(16)	27	(34)
90		7		5		6		3		1		17	
	[illegible]	.26		.25		.21		.21		.22		.26	
	Jan-Apr	.19	.14	.17	.12	.15	.10	.15	.10	.18	.14	.22	.18
	May-Aug	.12	.10	.11	.09	.09	.06	.09	.08	.13	.11	.16	.15
	Sep-Dec	.08	.08	.06	.06	.04	.04	.04	.04	.07	.07	.11	.11
90		.04		.04		.01		.01		.01		.06	
	[illegible]	.16		.16		.28		.31		.36		.46	
	Jan-Apr	.12	.08	.11	.08	.16	.08	.17	.08	.20	.10	.27	.16
	May-Aug	.08	.07	.07	.06	.06	.04	.05	.04	.07	.05	.13	.11
	Sep-Dec	.05	.06	.04	.04	.00	.02	.00	.02	.00	.02	.06	.05
		.03		.02		.00		.00		.00		.03	
	[illegible]	9.4		10.9		13.3		13.0		11.1		10.9	
	Jan-Apr	7.5	5.8	8.6	6.9	9.6	8.2	8.1	6.3	6.4	4.4	6.8	4.4
	May-Aug	5.5	4.8	6.2	5.4	6.3	5.7	4.0	3.4	2.4	1.9	3.0	2.3
	Sep-Dec	3.7	3.7	4.3	4.0	3.7	2.9	1.3	0.5	0.0	0.2	0.0	0.6
90		2.3		2.8		2.0		0.0		0.0		0.0	
	[illegible]	231		153		86		47		50		321	
	Jan-Apr	135	69	106	70	73	60	36	24	39	27	251	188
	May-Aug	53	44	64	59	60	56	24	19	27	22	184	157
	Sep-Dec		25	35	50	51	53	13	14	16	17	131	131
		0		18		34		4		7		92	

Note: Left column reflects redistribution of four-month group statistics into monthly statistics (1974-1981)
Right column reflects adjustment for long-term runoff and rainfall regime (1940-1981) and determination coefficients (R^2).

TABLE B-8-5

ESTIMATED EXCEEDENCE PROBABILITY DISTRIBUTIONS OF WATER QUALITY PARAMETERS

LAKE PONTCHARTRAIN [illegible]

Exceed. Prob. (%)	Parameter	R² [illegible]	R² 1st Mo.	R² 2nd Mo.	R² 3rd Mo.	R² [illegible] Mo.	JAN		FEB		MAR		APR		MAY		JUN	
[illegible]	SAL						[illegible]		[illegible]		[illegible]		3.7		3.5		4.0	
25	Jan-Apr	.34	[illegible]	.23	.21	[illegible]	[illegible]	4.5	4.1	3.9	2.5	3.2	3.2	3.1	3.0	3.1	3.4	3.5
	May-Aug	.77	.67	.73	[illegible]	.88	3.5	[illegible]	3.3	3.7	2.8	3.1	2.7	2.9	2.5	2.7	2.8	3.0
[illegible]	Sep-Dec	.70	.79	.73	.67	.61	2.6	3.5	2.5	3.5	2.1	3.0	2.1	2.7	2.1	2.4	2.3	2.6
9[illegible]							1.9		1.8		1.5		1.7		1.7		1.9	
[illegible]	TEMP						17.4		19.1		22.4		25.7		28.2		28.1	
25	Jan-Apr	[illegible]	.63	[illegible]	.78	.85	14.9		17.0		20.5		24.2		26.3		27.8	
50	May-Aug	.64	.72	.67	.61	.56	12.3		14.7		18.4		22.4		25.1		27.3	
[illegible]	Sep-Dec	[illegible]	[illegible]	.19	.17	.41	10.[illegible]		[illegible].5		16.4		20.5		23.7		26.7	
9[illegible]							8.2		10.6		14.7		18.8		22.4		26.1	
1	TURB						21		31		32		24		18		14	
2[illegible]	Jan-Apr	.51	.82	1.00	1.00	.82	17	13	24	20	25	21	19	16	14	12	10	7
5[illegible]	May-Aug	.5[illegible]	.6[illegible]	.53	.47	.40	12	9	16	12	17	13	15	12	11	10	6	5
7[illegible]	Sep-Dec	.18	[illegible]	.12	.24	.36	7	6	9	6	10	8	10	9	7	8	3	3
9[illegible]							3		3		4		6		5		1	
1	TSS						44		47		49		48		55		49	
25	Jan-Apr	.63	[illegible]	.76	.75	.51	33	22	36	27	39	29	33	20	33	15	28	10
50	May-Aug	.13	.26	.17	.09	[illegible]	21	17	24	19	26	20	18	13	14	12	10	8
7[illegible]	Sep-Dec	[illegible]	[illegible]	.09	.17	.25	11	11	12	1[illegible]	12	8	5	6	1	9	6	7
99							4		1		0		0		0		0	
1[illegible]	[illegible]						.30		.27		.26		.25		.21		.14	
2[illegible]	Jan-Apr	[illegible]	[illegible]	.22	.76	.80	.20	.21	.20	.21	.20	.21	.17	.18	.14	.12	.09	.08
[illegible]	May-Aug	.67	.96	[illegible]	.84	.78	.12	.16	.13	.16	.13	.16	.11	.14	.08	.07	.05	.04
[illegible]	Sep-Dec	[illegible]	.6[illegible]	[illegible]	.42	.57	.07	.11	.07	.12	.08	.11	.06	.09	.05	.04	.03	.02
[illegible]							.04		.02		.03		.04		.04		.02	
[illegible]	[illegible]						.2[illegible]		.15		.12		.11		.09		.10	
2[illegible]	Jan-Apr	[illegible]	[illegible]	[illegible]	.69	[illegible]	.15	.11	.13	.11	.10	.09	.09	.08	.07	.07	.09	.09
[illegible]	May-Aug	[illegible]	.72	[illegible]	[illegible]	[illegible]	.1[illegible]	.08	.10	.08	.29	.08	.06	.07	.06	.06	.07	.07
[illegible]	Sep-Dec	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.05	.07	.06	.08	.07	.07	.06	.05	.05	.05	.06
[illegible]							.03		[illegible]		.06		.05		.04		.03	
[illegible]	[illegible]						[illegible]		6.6		5.8		5.8		6.3		6.8	
2[illegible]	Jan-Apr	[illegible]	[illegible]	.22	[illegible]	[illegible]	[illegible]	4.5	5.[illegible]	4.2	4.9	3.9	5.0	4.0	5.6	4.7	6.0	5.1
[illegible]	May-Aug	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4.0	4.1	3.8	3.9	3.7	4.1	3.9	4.7	4.5	5.1	4.9
[illegible]	Sep-Dec	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.[illegible]	2.9	3.[illegible]	2.9	3.5	3.2	3.8	3.8	4.3	4.2	4.6
[illegible]							[illegible]		2.0		2.0		2.4		3.0		3.4	
[illegible]	[illegible]						[illegible]		199		156		510		1824		2864	
[illegible]	Jan-Apr	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	171	161	130	142	293	298	753	137	1053	119
	May-Aug	[illegible]	.29	[illegible]	[illegible]	[illegible]	[illegible]	13	141	154	130	113	83	230	0	0	0	0
	Sep-Dec	.37	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	112	126	76	83	0	109	0	0	0	0
[illegible]							[illegible]		86		44		0		0		0	

Exceed. Prob. (%)	Parameter	JUL		AUG		SEP		OCT		NOV		DEC	
[illegible]	SAL	4.6		5.4		7.4		9.3		9.2		7.[illegible]	
25	Jan-Apr	3.9	4.1	4.5	4.9	5.9	6.3	7.3	7.8	[illegible]3	7.6	6.0	[illegible]
	May-Aug	3.2	3.5	3.[illegible]	3.9	4.4	5.0	5.3	6.1	5.3	6.1	4.6	[illegible].2
[illegible]	Sep-Dec	2.6	3.0	2.8	[illegible]	3.2	3.9	3.6	4.7	3.7	4.8	3.4	[illegible].3
9[illegible]		2.1		2.1		2.4		2.3		2.4		2.4	
[illegible]	TEMP	29.1		30.1		28.8		25.7		21.6		19.0	
25	Jan-Apr	28.8		29.2		27.1		23.6		19.2		16.2	
50	May-Aug	28.3		28.0		25.1		21.3		16.6		13.4	
[illegible]	Sep-Dec	27.7		26.8		23.1		19.1		14.2		10.8	
9[illegible]		27.1		25.5		21.[illegible]		17.2		12.2		8.8	
1	TURB	11		9		[illegible]		8		8		14	
2[illegible]	Jan-Apr	8	6	7	5	[illegible]	4	6	5	6	3	12	9
5[illegible]	May-Aug	5	5	5	5	4	4	5	5	4	3	9	8
7[illegible]	Sep-Dec	3	4	3	4	3	4	4	5	2	[illegible]	6	7
9[illegible]		1		1		1		2		0		4	
1	TSS	48		43		32		22		23		34	
25	Jan-Apr	29	13	26	11	21	10	14	7	16	9	24	14
50	May-Aug	13	12	12	11	11	10	8	7	9	8	13	12
7[illegible]	Sep-Dec	5	11	6	11	6	10	3	6	4	7	6	1[illegible]
99		1		3		3		1		2		1	
1[illegible]	[illegible]	.11		.16		.20		.24		.26		.3[illegible]	
2[illegible]	Jan-Apr	.05	.04	.09	.06	.10	.05	.13	.07	.14	.0[illegible]	.17	.12
[illegible]	May-Aug	.02	.01	.04	.03	.03	.02	.05	.04	.05	.03	.08	.06
[illegible]	Sep-Dec	.00	.00	.02	.01	.00	.01	.01	.02	.00	.02	.02	.03
[illegible]		.00		.02		.00		.00		.00		.00	
[illegible]	[illegible]	.15		.19		.33		.42		.44		.30	
2[illegible]	Jan-Apr	.11	.11	.13	.12	.21	.13	.22	.10	.24	.11	.18	.10
[illegible]	May-Aug	.07	.08	.07	.08	.10	.09	.07	.06	.08	.07	.07	.06
[illegible]	Sep-Dec	.04	.06	.02	.05	.02	.04	.00	.03	.00	.04	.00	.03
[illegible]		.02		.00		.00		.00		.00		.00	
[illegible]	[illegible]	6.9		7.1		9.1		10.2		10.[illegible]		8.0	
2[illegible]	Jan-Apr	5.9	4.9	5.8	4.7	6.7	4.9	6.5	5.0	6.5	5.0	5.7	4.0
[illegible]	May-Aug	4.8	4.5	4.4	4.1	4.3	3.4	3.2	2.2	3.3	2.2	3.4	2.5
[illegible]	Sep-Dec	3.7	4.0	3.1	3.4	2.5	2.2	1.1	0.2	1.1	0.1	1.5	1.2
[illegible]		2.8		2.0		1.1		0.0		0.[illegible]		0.2	
[illegible]	[illegible]	3438		2373		1090		1[illegible]7		111		142	
[illegible]	Jan-Apr	1563	144	1211	260	860	651	70	38	[illegible]	45	107	79
	May-Aug	67	59	295	260	662	619	38	30	43	35	75	67
	Sep-Dec	0	54	0	260	532	597	15	25	19	28	50	58
[illegible]		0		0		662		2		[illegible]		34	

[illegible] Left columns refer to redistribution [illegible] up statistics into monthly statistics (1974–1981).
Right columns refer to [illegible] and rainfall regime (19[illegible]–19[illegible]) [illegible] determination coefficients (R²).

adjustments to these values should be made to be more consistent with the approximately 4-decade base period runoff and rainfall data.

H.8.15. The 1974-1981 period was marked by higher-than-long term normal discharge rates for nearly all months at the three river stations, and by higher-than-normal rain amounts for most months at the New Orleans gage. These adjustments produced for shifts in the 25-, 50-, and 75-percentile values between the recent and long-term data set for each runoff and rainfall gage. Corresponding shifts were applied to the 25-, 50-, and 75- percentile parameter values. Finally, in recognition of the varying influence of hydrologic events on different parameters during different months of the year, differences between 50- and 25-percentile parameter values, and between the 50- and 75- percentile values were reduced in proportion to the appropriate R^2 value in each case. This was done on the presumption that amounts of variance from the median value in response to runoff-rainfall amounts should be in accordance with the percent of each parameter's variance explainable by these variables, e.g. if $R^2 = 0.86$, the range between the predetermined 50- and 75- percent exceedence parameter values should be multiplied by 0.86 to obtain the adjusted 75- percent value. The parameter values that were adjusted to reflect base-period hydrologic data appear on the right side of each monthly column on Tables H-8-3 through H-8-5, and are shown for exceedence probabilities of 25-, 50-, and 75- percent only. Although reasonably good correlations were sometimes obtained for water temperature with respect to runoff and rainfall, it was acknowledged that other climatic factors, such as air temperature, Gulf of Mexico water movement, and wind effects are very important determinants of water temperature. Since these factors were not included in the analysis, it was decided to make no further adjustments to temperature data, and in effect assume that the monthly distributions are representative of the base period. A description of the procedures and

calculations for these parameter value adjustments is on file at the New Orleans District Office.

H.8.16. In order to improve the predictive reliability of the analysis for the portion of Lake Pontchartrain most likely to be significantly affected by diversion of Mississippi River water, salinity and temperature data for three other lake stations: South End of Causeway (SC); near Bayou LaBranche (BLB); and Little Woods (LW) were correlated with concurrent data at the three primary stations (MC,PM, and IHNC) using the STEPWISE regression model. A seventh station, Mouth of Bayou LaCombe (BLC) was subsequently correlated with the Mid-Causeway, Little Woods, and IHNC stations for temperature and salinity. Regression statistics for the SC, BLB, LW, and BLC station correlations were used to develop a table of monthly probability distributions of temperature and salinity values corresponding to 25-, 50- and 75- percent exceedence drought conditions. (Table H-8-6).

H.8.17. Maps depicting the patterns of salinity and temperature for the months of March, April, May, June, August and November are shown as plates H-14 through H-19. A limited comparison with temperature and salinity data at the station located at the Mouth of Bayou LaCombe permitted the extension of salinity and temperature contours to the north shore area. These maps are potentially useful for the delineation of patterns of variation of the other parameters among the three primary stations and the Bayou LaCombe station, and ultimately to the additional area encompassed by the other south shore stations. Water quality data collected during the 1973 Mississippi River flood at the south shore stations would be of some value in estimation of relative ambient parameter levels at those locations. An eighth lake station, for which approximate ambient parameter levels were estimated during the 1979 flood period on the basis of its location relative to other stations, is particularly valuable for construction of with-project parameter

TABLE [illegible] SALINITY AT SOUTH END CAUSEWAY, [illegible] AT LITTLE WOODS, [illegible] BAYOU LABRANCHE [illegible] AT MOUTH OF BAYOU LACOMBE [illegible]

Station / parameter	[illegible]	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
SOUTH END CAUSEWAY																									
Salinity	[illegible]	[illegible]	[illegible] 2.5 1.6	[illegible]	[illegible]	3.8 [illegible] 2.7 1.3 0.9	2.7 2.5 2.3	[illegible] 2.6 1.9 [illegible] 0.8	[illegible] 2.3 1.9	3.6 [illegible] 1.9 1.0 [illegible]	3.0 2.4 1.7	4.2 [illegible] [illegible] [illegible] 1.1	[illegible]	[illegible] [illegible] [illegible] 1.9 [illegible]	[illegible]	[illegible] 3.7 2.6 1.7 1.1	3.9 3.3 2.3	[illegible] 3.8 [illegible] 1.1 0.8	[illegible] 3.7 [illegible]	5.8 4.3 2.8 1.5 1.5	4.5 3.7 2.7	5.9 [illegible] 2.9 1.6 [illegible]	[illegible]	[illegible] [illegible] 2.6 1.5 0.8	[illegible] 3.4 3.1
Temperature		[illegible] [illegible] [illegible] [illegible] 8.[illegible]		[illegible] [illegible] [illegible] [illegible] 9.6		[illegible] 18.4 16.5 [illegible] 13.4		[illegible] 21.7 [illegible] 18.4 [illegible]		[illegible]		29.2 27.4 [illegible] 27.0 26.4		[illegible] 29.2 28.8 28.3 [illegible]		[illegible] 29.9 28.7 27.4 [illegible]		29.7 27.9 25.7 23.4 21.2		[illegible] [illegible] [illegible] 21.2 20.9		17.5 17.2 [illegible] [illegible] [illegible]		18.7 [illegible] [illegible] [illegible] [illegible]	
LITTLE WOODS																									
Salinity	[illegible]	[illegible] [illegible] [illegible] 3.2 2.6	[illegible] [illegible] 3.9	[illegible] 4.1 3.3 2.6 2.0	4.3 4.0 3.4	4.5 [illegible] 3.2 [illegible] 2.0	4.1 3.6 3.1	4.6 3.9 3.2 2.5 2.0	4.0 3.5 3.0	4.2 3.6 2.7 2.2 1.6	3.8 3.3 2.7	4.6 3.4 [illegible] 2.0 1.4	3.6 3.1 2.7	4.2 3.5 2.8 2.1 1.6	3.7 3.2 2.5	5.2 [illegible] 3.7 2.9 2.2	[illegible] 4.3 3.3	[illegible]	[illegible]	7.1 6.1 4.9 3.7 2.7	[illegible] 6.4 5.2	[illegible] 6.2 5.6 3.8 2.8	6.8 6.5 5.3	6.4 [illegible] 4.4 3.6 [illegible]	[illegible] 4.9 [illegible]
Temperature		[illegible] 14.9 [illegible] 11.0 9.3		16.9 [illegible] 13.5 [illegible] 10.3		19.3 17.9 16.3 [illegible] 13.3		22.3 [illegible] 19.6 18.2 16.9		[illegible] 24.7 23.7 22.7 21.8		26.7 [illegible] 25.9 [illegible] 25.1		27.9 27.5 27.1 26.7 26.2		28.6 27.7 26.7 25.7 24.9		27.9 [illegible] [illegible] 22.5 [illegible]		23.7 22.2 20.5 19.8 17.3		20.5 18.9 17.1 15.1 13.5		[illegible] [illegible] 14.0 [illegible] 10.1	
BAYOU LABRANCHE																									
Salinity	[illegible]	[illegible] 2.2 1.3 0.3 [illegible]	[illegible]	[illegible] [illegible] 1.2 0.2 [illegible]	[illegible] [illegible] 1.7	3.2 2.3 [illegible] [illegible] .2	[illegible] 2.1 1.9	3.3 2.4 1.5 0.3 0.3	2.4 2.2 1.8	3.3 2.4 1.5 0.5 0.3	2.6 2.1 1.3	[illegible] 2.4 1.5 0.5 0.3	2.6 2.1 1.2	3.3 2.4 1.5 0.5 0.3	2.7 2.1 1.1	3.3 2.4 1.5 0.5 0.3	2.7 2.1 1.1	3.5 2.6 1.6 0.9 0.2	[illegible] 2.1 1.5	4.1 3.0 [illegible] [illegible] 0.0	3.3 [illegible] 1.6	4.2 3.1 1.9 1.0 0.1	3.3 2.5 1.8	3.6 2.7 1.8 .2 0.0	2.8 2.2 1.7
Temperature		17.6 [illegible] 12.4 [illegible] [illegible]		[illegible] 15.7 13.7 11.5 [illegible]		[illegible] [illegible] [illegible] 14.9 13.3		23.4 22.0 20.3 18.5 16.9		27.0 25.8 24.4 22.9 21.5		28.2 27.8 27.3 26.7 [illegible]		[illegible] 29.2 [illegible] 28.1 27.4		31.1 30.0 [illegible] 27.3 26.0		29.0 27.1 25.0 22.9 [illegible]		25.5 23.3 20.9 14.7 16.5		[illegible] 19.2 16.6 14.1 12.0		18.7 13.1 13.1 10.2 7.5	
BAYOU LACOMBE																									
Salinity		[illegible]	[illegible]	[illegible] 3.2 2.3 1.5 0.9	(3.3) (2.9) (2.4)	3.6 2.8 [illegible] 1.2 0.5	(2.7) (2.3) (1.9)	3.2 2.4 1.7 [illegible] 0.5	(2.5) (2.1) (1.5)	2.8 2.3 1.2 0.9 [illegible]	(2.5) (1.9) (1.3)	2.5 1.8 [illegible] 0.7 [illegible]	(2.0) (1.6) (1.3)	3.0 2.0 1.3 0.8 [illegible]	(2.3) (1.8) (1.1)	5.1 3.5 2.2 1.3 0.8	(4.5) (2.9) (1.5)	4.4 [illegible] [illegible] 2.0 1.4	(4.0) (3.2) (2.1)	5.3 4.4 3.4 2.4 1.6	(4.6) (4.0) (3.0)	5.4 4.5 3.4 2.5 1.7	(4.5) (4.1) (3.6)	4.9 4.2 3.4 2.6 1.9	(4.4) (3.8) (3.5)
Temperature		[illegible]		[illegible]		21.6 19.8 17.9 [illegible] 14.3		24.8 23.4 21.6 19.9 18.2		28.3 27.0 26.1 25.2 24.3		[illegible] 28.2 27.8 27.3 26.9		[illegible] 29.0 28.6 28.2 27.7		30.0 29.3 28.3 27.2 26.5		29.8 [illegible] [illegible] 23.0 21.9		[illegible] [illegible] 21.3 19.2 17.1		[illegible] [illegible] 16.3 13.8 11.8		[illegible] [illegible] 12.9 10.2 6.3	

[illegible] column reflects [illegible] statistics (the monthly statistics 1974 - 1981).
Right column reflects adjustment [illegible] rainfall [illegible] (19[illegible] - 1981) [illegible] determination coefficients [illegible].

contours. This station, located about 10 miles from Kenner and about the same distance from the diversion site, was analyzed, along with the three primary stations, for predicted parameter level changes associated with project operation.

H.8.18. Having determined the adjusted 25-, 50-, and 75-percent drought parameter values at the primary stations (MC, PM, and IHNC), the next task was to modify the original multiple regression coefficients to reflect those values. Essentially, this amounted to finding a linear equation ($Y = a + bX$) in terms of the variant component, $\underline{\Delta}$ * of each original regression equation that would cause the $\underline{\Delta}$ values to change by amounts approximately equal to the shifts from the original to modified 25-, 50-, and 75- percent drought parameter values. By treating $\underline{\Delta}$ as the X term in the linear equation, the modified $\underline{\Delta}$, or Y term, could be found by solving the equation. Best-fit equations were determined for each parameter and month such that application of coefficients a and b would cause each original $\underline{\Delta}$, or X, to become equal to the modified $\underline{\Delta}$, or Y. Details of the procedure and tables of $\underline{\Delta}$ conversions are on file in the New Orleans District Office.

ANALYSIS OF 1979 BONNET CARRE' SPILLWAY DIVERSION

H.8.19. Both the original and modified regression equations were then applied to the 1-, 2-, and 3- month average river discharge and rainfall amounts pertinent to the 1979 Bonnet Carre' Spillway operation period. The set of regression equations that most nearly yielded the parameter levels that were observed at the primary lake stations in mid-April and mid-July (just before opening and about six weeks after closing of the

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*The variant, $\underline{\Delta}$, consists of: $bx_1 + cx_2 + dx_3 + \ldots$ (coeff.) X_n in a regression equation having n independent variables.

.lway) in each case was selected as most representative for that ameter and station. The 1979 Bonnet Carre' Spillway operation period of greater value in assessing impacts of freshwater diversion than ier 1973 or 1975 because of: the number of frequently sampled itions in the southwestern to mid-lake area; the frequent sampling at ocation within the spillway; the fact that three of the sampled tions in 1979 had approximately 6 1/2 consecutive years of regularly ected data; the inclusion within this monitoring period of the 1979 it, but not the 1973 event; and the 1975 event having been too brief letermine effects of continuous diversion over periods of several s and months.

.20. Table H-8-7 shows the observed and estimated ambient (without lway discharge) parameter values at the three lake stations for rsion-affected months during 1979. The values listed represent mid-h levels. April and July observations represent single samples, e May and June are averages of five samples. Estimated eratures, assumed not to be significantly influenced by runoff and ifall, are thus shown as equal to observed values at each station in l and July. Bonnet Carre' Spillway (BCS) observed parameter levels iid-month are shown in the table for May and June. Comparisons of listed parameter values for April and July reveal that: salinity mates were accurate for all stations; turbidity estimates were irate for MC, low for PM, and high for IHNC; and suspended residue mates were inconsistent (low, then high) for MC, fair for PM, and for IHNC. Nitrate estimates were again inconsistent for MC, good PM, and high for IHNC; phosphorus was well-estimated at MC, high at and good to low at IHNC. Copper estimates were somewhat nsistent at MC, high at PM, and fair at IHNC; while fecal coliform estimated high to good at MC, and high at PM and IHNC.

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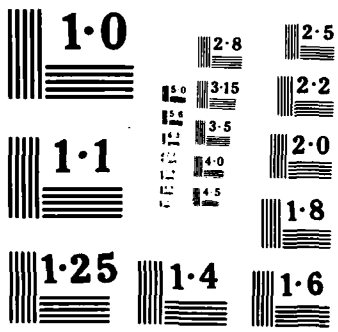
1·0
2·8
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1·6

TABLE H-8-7

COMPARISON OF OBSERVED AND ESTIMATED MID-MONTH AMBIENT PARAMETER VALUES IN LAKE PONTCHARTRAIN DURING 1979 FLOODWATER DIVERSION PERIOD

	(^{o}/oo) SAL		(^{o}C) TEMP		(JTU) TURB		(MG/L) RSS		(MG/L) NIT		(MG/L) PHOS		(UG/L) COP		(MPN/100 ML) FCOL	
	OBS.	EST.	OBS.	EST.	OBS.	EST.	OBS.	EST.	OBS.	EST.	OBS.	EST.	OBS.	EST.	OBS.	EST.
APRIL 1979																
MID-CAUSEWAY	1.5	1.5	22.6	22.6	15	16	31	11	.04	.13	.03	.06	8.0	5.4	4	42
PASS MANCHAC	0.1	0.4	22.5	22.5	9	2	54	36	.16	.19	.09	.15	8.0	10.1	24	49
IHNC ENTRANCE	2.5	2.7	22.5	22.5	7	21	7	6	.08	.22	.05	.08	6.0	5.3	9	77
MAY 1979																
BONNET CARRE' SPILLWAY	0.1		19.8		82		89		2.06		.16		7.2		179	
MID-CAUSEWAY	0.8	1.0	25.1	26.5	8	15	6	21	.41	.16	.02	.05	3.6	5.9	6	4
PASS MANCHAC	0.1	0.6	24.2	26.6	16	16	6	12	.15	.18	.09	.02	5.6	7.1	14	29
IHNC ENTRANCE	0.1	2.7	23.4	25.9	31	20	22	14	1.78	.21	.12	.10	4.8	5.3	75	17
JUNE 1979																
BONNET CARRE' SPILLWAY	0.2		24.2		69		84		1.20		.18		5.6		68	
MID-CAUSEWAY	0.8	1.2	27.1	28.9	9	7	10	14	.16	.00	.21	.05	4.8	5.7	1	7
PASS MANCHAC	0.1	0.3	27.1	29.1	22	11	27	16	1.09	.22	.06	.07	4.6	6.9	5	5
IHNC ENTRANCE	2.6	1.0	26.2	28.0	13	26	18	12	.43	.23	.10	.23	4.6	5.2	7	11
JULY 1979																
MID-CAUSEWAY	0.4	0.3	28.2	28.2	10	12	12	28	.36	.25	.02	.03	2.0	2.9	4	2
PASS MANCHAC	0.3	0.3	28.4	28.4	15	7	24	20	.15	.19	.01	.12	4.0	6.2	4	8
IHNC ENTRANCE	2.6	2.5	29.6	29.6	4	32	4	17	.04	.33	.25	.04	5.0	6.3	4	27

Explanation of Parameter symbols: SAL (Salinity; TEMP (Temperature); TURB (Turbidity); RSS (Suspended Solids Residue @ 105 ^{o}C); NIT (Nitrite + Nitrate); PHOS (Total Phosphorus); COP (Total Copper) FCOL (Fecal Coliform).

Dates of Observations: April 16; May 11-17 (5 Observations); June 10-14 (5 Observations); July 18.

H.8.21. In review, it is believed that overall improved agreement between observed and estimated ambient values might have been achieved if some of the presumed dependent or interdependent parameter relationships had not been used in the regression analysis. In particular, those parameters for which fecal coliform was allowed to be an independent variable (turbidity, suspended residue, nitrate, phosphorus) probably underwent some distortion through accidental correlation, even though a degree of association between the parameters should be expected. The characteristic often-rapid change in fecal coliform levels within short periods of time offers a much greater chance of nonrepresentativeness, particularly when the sampling is at infrequent intervals, than for other parameters. Future analysis should include further investigation as to the true validity of parameter interrelationships, and perhaps eliminate some of these in redefining the equations.

H.8.22. Frequent sampling of water quality parameters was conducted in the lake and the spillway itself throughout the spillway discharge period, continuing until about two weeks after closing. The data collection period was divided into consecutive 5- to 8-day segments during which sets of 5 observations were made at each sampling location. Average parameter values for each set of observations in the spillway and at the primary lake stations were tabulated. Frequent spillway discharge measurements were made throughout the period, and those averaged values are shown for the same 5- to 8-day intervals.

H.8.23. The estimated mid-month parameter values were tabulated against the observed values for each measurement interval, as shown on Table H-8-8. The procedure for adjusting these and intermediate estimates to maximise their compatibility with observed measurements is described below, using turbidity as an example.

TABLE H-8-8

ADJUSTMENT OF ESTIMATED AMBIENT PARAMETER VALUES

Interval		Salinity (°/oo) OBS.	Salinity EST.	Salinity ADJ EST.	Temperature (°C) OBS.	Temperature EST.	Temperature ADJ EST.	Turbidity (JTU) OBS.	Turbidity EST.	Turbidity ADJ EST.	Suspended Residue (MG/L) OBS.	Suspended Residue EST.	Suspended Residue ADJ EST.
	Mid-Causeway												
1	Apr 16, 1979	1.5	1.5	1.5	22.6	22.6	22.6	15	16	15	31	11	31
2	19-24	1.4		1.6	22.9		23.4	15		13	27		24
3	25-29	1.7		1.7	22.7		24.1	16		11	18		18
4	Apr 30-May 05	1.4		1.5	22.6		24.9	10		9	12		12
5	06-10	1.3		1.4	24.3		25.7	7		7	9		9
6	11-17	0.8	1.0	1.2	25.1	26.5	26.5	8	15	8	6	21	6
7	18-22	0.7		1.2	25.3		27.0	15		8	16		6
8	23-30	0.6		1.3	25.0		27.6	29		7	33		7
9	May 31-Jun 04	0.4		1.3	25.9		28.2	55		7	54		7
10	05-09	0.4		1.4	28.7		28.7	23		6	17		8
11	10-14	0.8	1.2	1.4	27.1	28.9	28.9	9	7	6	10	14	8
12	Jun 25	(0.7)		(1.0)	(29.5)		(29.5)	(9)		(7)	(11)		(9)
13	Jul 18	0.4	0.3	0.4	28.2	28.2	28.2	10	12	10	12	28	12
	Pass Manchac												
1	Apr 16, 1979	0.1	0.4	0.1	22.5	22.5	22.5	9	2	9	54	36	54
2	19-24	0.7		0.7	22.1		23.3	47		11	71		40
3	25-29	0.3		0.7	21.6		24.1	23		12	39		29
4	Apr 30-May 05	0.1		0.7	22.6		24.9	25		13	15		15
5	06-10	0.1		0.6	23.5		25.7	14		14	13		13
6	11-17	0.1	0.6	0.6	24.2	26.6	26.6	16	16	16	6	12	6
7	18-22	0.1		0.5	25.8		27.1	18		14	11		7
8	23-30	0.2		0.5	24.8		27.7	21		12	22		9
9	May 31-Jun 04	0.1		0.4	26.3		28.2	11		11	13		11
10	05-09	0.1		0.4	28.2		28.6	10		10	12		12
11	10-14	0.1	0.3	0.3	27.1	29.1	29.1	22	11	11	27	16	18
12	Jun 25	(0.1)		(0.3)	(30.3)		(30.3)	(19)		(12)	(26)		(20)
13	Jul 18	0.3	0.3	0.3	28.4	28.4	28.4	15	7	15	24	20	24
	IHNC												
1	Apr 16, 1979	2.5	2.7	2.5	22.5	22.5	22.5	7	21	7	7	6	7
2	19-24	1.2		2.6	22.7		23.2	27		12	41		7
3	25-29	0.3		2.6	20.1		23.8	45		16	34		6
4	Apr 30-May 05	0.1		2.7	20.7		24.5	56		21	42		6
5	06-10	0.1		2.7	21.7		25.2	48		26	32		6
6	11-17	0.1	2.7	2.8	23.4	25.9	25.9	31	20	31	22	14	5
7	18-22	0.2		2.8	23.3		26.3	32		25	34		5
8	23-30	0.5		2.7	23.6		26.8	19		14	14		5
9	May 31-Jun 04	0.7		2.7	24.0		27.3	8		8	8		5
10	05-09	1.0		2.6	27.4		27.6	6		6	5		5
11	10-14	2.6	1.0	2.6	26.2	28.0	28.0	13	26	13	18	12	5
12	Jun 25	(2.6)		(2.6)	(28.2)		(28.6)	(10)		(10)	(13)		(5)
13	Jul 18	2.6	2.5	2.6	29.6	29.6	29.6	4	32	4	4	17	4

(1) The April and July mid-month estimates were adjusted to equal the observed turbidity values, i.e. for the Pass Manchac station, the estimates of 2 and 7 were changed to 9 and 15 respectively.

(2) The May and June estimates would first be adjusted upward in linear proportion to the April and July estimate adjustments, i.e. May, from 16 to 23, and June, from 11 to 19. If, however, either of these adjusted values would exceed the observed value, which is unlikely since the river diversion would tend to increase lake turbidity, it is instead assumed equal to the observed value, thus the mid-April estimate remains at 16.

(3) The intermediate estimates for intervals 2 through 5, between mid-April and mid-May, are determined by linear interpolation, as shown.

(4) This could not be done between mid-May and mid-June, however because of the low observed values of 11 and 10, in intervals 9 and 10. Estimates for intervals 7 and 8 were then determined by linear interpolation between the adjusted intervals 6 and 9.

(5) To achieve linearity between intervals 10 and 13, the mid-June estimate was adjusted downward to a value of 11, and interval 12 was determined to be equal to 12.

This procedure, based on the assumption of linear variation between known values, was followed in all the estimate adjustments, with the further assumption that all parameters, except salinity and temperature, would tend to have lower ambient than observed values because of positive gradients from the spillway to the lake. Salinity and temperature were assumed to have negative gradients.

H.8.24. Tables H-8-9 through H-8-18 contain the estimated and observed parameter values at each primary lake station, and at a fourth station which was sampled frequently during the diversion period, and the appropriately lagged and attenuated Bonnet Carre' Spillway observed parameter values and discharges in consecutive five- to eight- day averaged intervals. Estimated lag times were determined as: The number of intervals between peak spillway discharge and peak difference between estimated and observed parameter values at the lake station, multiplied by six days (the average length of the intervals). It will be noted that the observed values have been smoothed by averaging the value for each interval with the preceding and following values. It was discovered that this adjustment generally improved the correlation of parameter level changes at the stations relative to parameter level gradients between the spillway and lake.

H.8.25. After a number of trial combinations it was learned that derived relationships between gradient ratio (Y) and gradient flux (X) were compatible and consistent for most parameters and stations, particularly for periods antecedent to and including peak gradient ratio and gradient flux. These relationships were usually expressed as parabolic equations ($y = a + bx + cx^2$), and occasionally as cubic equations ($y = a + bx + cx^2 + dx^3$). The equations were plotted on graph paper for use in determination of with-project parameter levels. Known or suspected influences by other factors, including short-duration high tributary runoff or intense local rainfall, caused less direct procedures to be substituted for certain station-parameter combinations.

PARAMETER LEVEL CHANGES UNDER PROJECT CONDITIONS

H.8.26. Table H-8-19 shows the predicted April through June ambient and with-project diversion levels of the eight parameters at each lake station. In those cases where indirect methods were applied, amounts of

TABLE 6-8-9

COMPARATIVE ANALYSIS OF PARAMETER LEVELS DURING
1979 BONNET CARRE' SPILLWAY OPERATIONS

PARAMETER
NITRATE AND NITRITE (MG/L)

Interval	Date (Each Station)	Lake Pontchartrain Station					(1) OBS Lake	(1) ADJ Lake	(2) (Ambient) EST Lake	(3) ADJ - EST (1) - (2)	(4) OBS BCS	(5) OBS - EST (4) - (2)	(6) Y Gradient Ratio (3)/(3) + (5)	(7) Discharge (1000 CFS)	(8) X Gradient Flux (5) x [illegible]
		Mid-Causeway								(36-Day Lag)			(36 Day Lag)		
1	Apr 16	R^2	.96	X	Y	Y_{ADJ}	.04		.04	.00	.74	.70	–	0	–
2	19-24	a	.01	0	.01	~~.00~~	.09	.07	.06	.01	1.08	1.02	.01	20	0
3	25-29	b	.001	2	.01		.08	.09	.08	.01	1.39	1.31	.01	50	0
4	May 30-05	c	$-3x10^{-6}$	10	.02		.11	.12	.11	.01	1.61	1.50	.01	80	0
5	06-10			60	.07		.17	.23	.15	.08	1.73	1.58	.05	100	30
6	11-17						.41	.29	.20	.09	1.78	1.58	0.05	120	60
7	18-22						.28	.34	.16	.18	1.79	1.63	.1[illegible]	120	110
8	23-30						.33	.30	.11	.19	1.81	1.70	.1[illegible]	120	190
9	Jun 01-04						.29	.32	.07	.25	1.83	1.76	.12	100	230
10	05-09						.34	.26	.03	.23	1.86	1.83	.11	70	260
11	10-14						.16	.23							
12	25						.19								
		Pass Manchac								(48-Day Lag)			(48-Day Lag)		
1		R^2	1.00	X	Y		.16		.16	.00	.76	.60	–	0	–
2		a	$6x10^{-?}$	0	.00		.29	.24	.15	.09	1.06	.91	.09	0	0
3		b	.001	2	.00		.27	.23	.14	.09	1.34	1.20	.07	0	0
4		c	$1x10^{-5}$	10	.01		.14	.18	.14	.04	1.55	1.41	.03	0	0
5		d	$-4x10^{-8}$	60	.09		.13	.14	.13	.01	1.69	1.56	.01	0	0
6							.15	.15	.15	.00	1.76	1.61	.00	10	20
7							.17	.22	.16	.06	1.79	1.63	.04	20	30
8							.34	.34	.17	.17	1.79	1.62	.09	40	60
9							.52	.56	.18	.38	1.80	1.62	.19	70	110
10							.83	.81	.18	.63	1.81	1.63	.28	100	160
11							1.09	.95	.19	.76	1.83	1.64	.32	120	200
12							.93								
		IHNC								(18-Day Lag)			(18-Day Lag)		
[illegible]		R^2	[illegible]	X	Y	Y_{ADJ}	[illegible]		[illegible]	[illegible]	[illegible]	0.59	–	0	–
[illegible]		[illegible]	[illegible]	[illegible]	.14	~~.00~~	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.06	.40	10	10
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.46	30	40
[illegible]				[illegible]	.22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible].67	.5[illegible]	60	100
[illegible]				[illegible]	.29	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.73	.49	120	[illegible]
[illegible]							[illegible]	[illegible]	[illegible]	1.73	[illegible]	1.76	.50	160	280
[illegible]							[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.82	[illegible]	[illegible]	310
[illegible]							[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible].89	[illegible]	[illegible]	270
[illegible]							[illegible]	[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	190
[illegible]							[illegible]	[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	110
[illegible]							[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	.23	20	30
[illegible]							[illegible]								
												[illegible]	.1		2
												[illegible]ues	.26		6

TABLE E-8-14

COMPARATIVE ANALYSIS OF PARAMETER LEVELS DURING
1979 BONNET CARRE SPILLWAY OPERATIONS

LAKE PONTCHARTRAIN 9.7 MILES NW OF KENNER

NITRATE + NITRATE   FECAL COLIFORM   TURBIDITY

Interval	Date 1979	Station	Parameter					(1) OBS Lake	(1) ADJ Lake	(2) (Ambient) EST Lake	(3) ADJ - EST (1) - (2)	(4) OBS BCS	(5) OBS - EST (4) - (2)	(6) Y Gradient Ratio (3)/(3) + (5)	(7) Discharge (1000 CFS)	(8) X Gradient Flux (5) x (7)
			Nitrate + Nitrite (MG/L)									(36-Day Lag)			(36 Day Lag)	
1	Apr	16	R^2	.83	X	Y	Y_{ADJ}	(.13)		.13	.00	.74	.61	.00	0	0
2		19-24	a	.09	0	.09	.0?	.64	.66	.12	.54	1.08	.96	.36	0	0
3		25-29	b	.01	2	.10	.07	1.22	.82	.12	.70	1.39	1.27	.36	0	0
4	May	30-05	c	$-2x10^{-5}$	10	.14	.13	.62	1.00	.11	.89	1.61	1.50	.37	0	0
5		06-10			60	.35		1.18	.98	.11	.87	1.73	1.62	.35	20	30
6		11-17						1.17	1.22	.12	1.10	1.78	1.66	.40	40	70
7		18-22						1.35	1.41	.12	1.29	1.79	1.67	.44	70	120
8		23-30						1.74	1.54	.13	1.41	1.81	1.68	.46	110	180
9	Jun	01-04						1.56	1.64	.14	1.50	1.83	1.69	.47	130	220
10		05-09						1.64	1.46	.14	1.32	1.86	1.72	.43	140	240
11		10-14						1.20	1.30	.14	1.16	1.88	1.74	.40	130	230
12		25						(1.07)								
			Fecal Coliform (MPN/100 ML)									(0-Day Lag)			(0-Day Lag)	
1			R^2	1.06	X	Y			(19)	19	0	200	181	.00	0	0
2			a	$-1x10^{-12}$	0	.00			32	11	21	200	189	.10	150	28,000
3			b	$-1x10^{-7}$	5,000	.00			74	8	66	208	200	.25	220	44,000
4			c	$-1x10^{-1?}$	20,000	.05			4	4	0	97	93	.00	200	19,000
5					12?,000	1.93			6	6	0	135	129	.00	160	21,000
6									75	11	64	179	168	.28	100	17,000
7									10	3	7	141	138	.05	30	4000
8									4	3	1	97	94	.01	0	0
9									2	2	0	35	33	.00	0	0
10									2	2	0	4	2	.00	0	0
11									53	3	50	68	65	.37	0	0
12									(6)							
													Added X, Y Values	.135		22,000
														.065		6,000
														.025		2,000
														.100		12,000
			Turbidity (JTU)									(0-Day Lag)			(0-Day Lag)	
1			R^2	1.00	X	Y		(8)		8	0	106	98	.00	0	0
2			a	$3x10^{-10}$	0	.00		50	47	11	36	106	95	.27	150	14,000
3			b	$3x10^{-5}$	200	.01		82	57	13	44	111	98	.31	220	22,000
4			c	$-6x10^{-10}$	1,000	.03		38	50	16	34	89	73	.32	200	15,000
5					3,000	.08		30	40	18	22	92	74	.23	160	12,000
6					7,000	.17		52	40	21	19	82	61	.24	100	6,000
7								37	49	18	31	71	53	.37	30	2,000
8								56	42	13	29	52	39	.43	0	0
9								32	52	10	42	29	19	.69	0	0
10								66	63	9	54	18	9	.86	0	0
11								88	58	16	42	69	53	.44	0	0
12								(18)								

COMPARATIVE ANALYSIS OF PARAMETER LEVELS DURING
1979 BONNET CARRE' SPILLWAY OPERATIONS

PARAMETER
PHOSPHORUS, TOTAL (MG/L)

Interval	Date (Each Station)	Lake Pontchartrain Station	(1) OBS Lake	(1) ADJ Lake	(2) (Ambient) EST Lake	(3) ADJ - EST (1) - (2)	(4) OBS BCS	(5) OBS - EST (4) - (2)	(6) Y Gradient Ratio (3)/(3) + (5)	(7) Discharge (1000 CFS)	(8) X Gradient Flux (5) x (7)
		Mid-Causeway					(48-Day Lag)			(48 Day Lag)	
1	Apr 16	R^2 1.00 X Y	.03		.03	.00	.11	.08	-	0	0
2	19-24	a $2x10^{-?}$ 0 .00	.06	.04	.03	.01	.16	.13	.07	0	0
3	25-29	b $1x10^{-5}$ 2 .01	.04	.05	.03	.02	.19	.16	.11	0	0
4	May 30-05	c $9x10^{-4}$ 6 .04	.04	.04	.02	.02	.21	.19	.10	0	0
5	06-10	12 .14	.04	.03	.02	.01	.22	.20	.05	0	0
6	11-17		.02	.07	.02	.05	.22	.20	.20	10	2
7	18-22		.15	.07	.02	.05	.22	.20	.20	20	4
8	23-30		.05	.09	.03	.06	.22	.19	.24	40	8
9	Jun 01-04		.08	.07	.03	.04	.22	.19	.17	70	13
10	05-09		.07	.12	.04	.08	.22	.1?	.31	100	18
11	10-14		.21	.13	.04	.11	.21	.17	.39	120	20
12	25		.18								
		Pass Manchac					(18-Day Lag)			(18-Day Lag)	
1		R^2 .88 X Y Y_{ADJ}	.09		.09	.00	.14	.05	-	0	0
2		a .26 0 .26 .00	.14	.11	.07	.04	.19	.12	.25	10	1
3		b -.003 2 .26 .17	.10	.11	.05	.06	.22	.17	.26	30	5
4		c $1x10^{-4}$ 6 .25 .22	.09	.10	.04	.06	.22	.18	.25	60	11
5		12 .24 .23	.10	.09	.02	.07	.23	.21	.25	120	25
6			.09	.10	.00	.10	.22	.22	.31	160	35
7			.10	.09	.00	.09	.21	.21	.30	170	36
8			.08	.09	.00	.09	.20	.20	.31	140	28
9			.09	.09	.01	.08	.18	.17	.32	100	17
10			.10	.08	.01	.07	.17	.16	.30	60	10
11			.06	.07	.01	.06	.17	.16	.27	20	3
12			.05								
		IHNC					(0-Day Lag)			(0-Day Lag)	
1		R^2 .94 X Y	.05		.05	.00	.22	.17	-	0	0
2		a $-1x10^{-5}$ 0 .00	.13	.10	.06	.04	.22	.16	.20	150	24
3		b .02 2 .03	.13	.13	.08	.05	.25	.17	.23	220	37
4		c $-3x10^{-4}$ 6 .09	.14	.14	.09	.05	.22	.13	.28	200	26
5		12 .16	.15	.14	.11	.03	.19	.08	.27	160	13
6			.12	.13	.12	.01	.16	.04	.20	100	4
7			.11	.10	.11	-.01	.18	0.07	.17	30	2
8			.07	.08	.07	.01	.16	.09	.10	0	0
9			.06	.06	.06	.00	.17	.11	.00	0	0
10			.04	.07	.04	.03	.18	.14	.18	0	0
11			.10	.09	.10	-.01	.18	.08	-.11	0	0
12			.12								

TABLE H-8-12

COMPARATIVE ANALYSIS OF PARAMETER LEVELS DURING
1979 BONNET CARRE' SPILLWAY OPERATIONS

LAKE PONTCHARTRAIN 9.7 MILES NNW OF KENNER

SUSPENDED RESIDUE TOTAL PHOSPHORUS TOTAL COPPER

Interval	Date (Each Station)	Parameter					(1) OBS Lake	(1) ADJ Lake	(2) (Ambient) EST Lake	(3) ADJ - EST (1) - (2)	(4) OBS BCS	(5) OBS - EST (4) - (2)	(6) Y Gradient Ratio (3)/(3) + (5)	(7) Discharge (1000 CFS)	(8) X Gradient Flux (5) x (7)
		Suspended Residue (MG/L)									(0-Day Lag)			(0 Day Lag)	
							(38)		38	0	-	-	-	0	0
1	Apr 16	R^2	.99	X	Y		55	75	38	37	269	231	.14	150	35,000
2	19-24	a	$4x10^{-4}$	0	.00		133	80	29	51	185	156	.25	220	34,000
3	25-29	b	$1x10^{-5}$	200	.00		51	70	23	47	182	159	.23	200	32,000
4	May 30-05	c	$-2x10^{-10}$	1000	.01		25	42	12	30	130	118	.20	160	19,000
5	06-10			2000	.03		50	33	11	22	89	78	.22	100	8,000
6	11-17			5000	.07		25	45	6	39	58	52	.43	30	0
7	18-22						60	37	6	31	52	46	.40	0	0
8	23-30						25	43	8	35	15	7	.83	0	0
9	Jun 01-04						44	58	9	49	28	19	.72	0	0
10	05-09						106	58	10	48	84	74	.39	0	0
11	10-14						(23)								
12	25														
		Phosphorus, Total (MG/L)									(42-Day Lag)			(42-Day Lag)	
1		R^2	.62	X	Y	Y_{ADJ}	(.08)		.08	.00	.06	-.02	-	0	0
2		a	.13	0	.13	.00	.12	.11	.06	.05	.11	.05	.50	0	0
3		b	.04	2	.20	.16	.14	.13	.07	.06	.16	.09	.40	0	0
4		c	-.002	6	.32	.31	.13	.13	.06	.07	.19	.13	.35	0	0
5				12	.40		.12	.13	.06	.07	.21	.15	.32	0	0
6							.13	.12	.05	.07	.22	.17	.29	10	2
7							.11	.12	.04	.08	.22	.18	.31	20	4
8							.13	.13	.04	.09	.22	.18	.33	40	7
9							.13	.13	.02	.11	.22	.20	.35	70	14
10							.15	.15	.03	.12	.22	.19	.39	100	19
11							.15	.12	.02	.10	.22	.20	.33	130	26
12							(.07)								
		Copper, Total (UG/L)									(6-Day Lag)			(6-Day Lag)	
1		R^2	.91	X	Y	Y_{ADJ}	(7.0)		7.0	0.0	4.0	-3.0	-	0	0
2		a	.02	0	.02	.00	6.0	7.3	5.5	1.8	8.0	2.5	.42	50	130
3		b	$3x10^{-4}$	50	.04	.03	8.8	6.2	3.9	2.3	12.0	8.1	.22	120	970
4		c	$-1x10^{-7}$	200	.08		3.8	5.6	2.8	2.8	11.8	9.0	.24	190	1,700
5				1,000	.23		4.2	5.0	3.4	1.6	9.5	6.1	.21	190	1,160
6							7.0	5.7	5.3	0.4	7.5	2.2	.15	150	330
7							6.0	6.4	4.3	2.1	6.1	1.8	.54	100	180
8							6.2	5.6	3.9	1.7	8.3	4.4	.28	40	180
9							4.6	5.0	3.7	1.3	8.3	4.6	.22	10	50
10							4.4	5.1	4.1	1.0	8.0	3.9	.20	0	0
11							6.4	5.1	4.6	0.5	5.6	1.0	.33	0	0
12							(4.6)								

TABLE H-8-13

COMPARATIVE ANALYSIS OF PARAMETER LEVELS DURING
197[illegible] BONNET CARRE' SPILLWAY OPERATIONS

PARAMETER
TEMPERATURE (°C)

Interval	Date (Lake Station)	Lake Pontchartrain Station					(1) OBS Lake	(1) ADJ Lake	(2) (Ambient) EST Lake	(3) EST - ADJ (2) - (1)	(4) OBS BCS	(5) OBS - EST (4) - (2)	(6) Y Gradient Ratio (3)/(3) + (5)	(7) Discharge (1000 CFS)	(8) X Gradient Flux (5) x (7)
		Mid-Causeway									(30-Day Lag)			(30-Day Lag)	
1	Apr 16	R^2	.99	X	Y		22.6		22.6	0.0	15.5	7.1	.00	0	0
2	19-24	a	.002	0	.00		22.9	22.7	23.4	0.7	15.6	7.6	.08	0	0
3	25-29	b	$2x10^{-4}$	20	.01		22.7	22.7	24.1	1.4	15.6	8.5	.14	0	0
4	May 30-05	c	$-8x10^{-9}$	100	.02		22.6	23.2	24.9	1.7	15.7	9.2	.16	10	100
5	06-10			600	.11		24.3	24.0	25.7	1.7	15.8	9.9	.15	40	400
6	11-17						25.1	24.9	26.5	1.6	16.0	10.5	.13	70	700
7	18-22						25.3	25.1	27.0	1.9	16.3	10.7	.15	110	1,200
8	23-30						25.0	25.4	27.6	2.2	16.7	10.9	.17	140	1,500
9	Jun 01-04						25.9	26.5	28.2	1.7	17.4	10.8	.14	150	1,600
10	05-09						28.7	27.2	28.7	1.5	18.4	10.3	.13	130	1,300
11	10-14						27.1	28.0	28.9	0.9	19.6	9.3	.09	100	900
12	25						28.3								
		Pass Manchac									(12-Day Lag)			(12-Day Lag)	
1		R^2	.90	X	Y	Y_{ADJ}	22.5		22.5	0.0	15.5	7.0	.00	0	0
2		a	.03	0	.03	.00	22.1	22.1	22.3	1.2	15.6	7.7	.13	20	200
3		b	$4x10^{-4}$	20	.04	.03	21.6	22.1	24.1	2.0	15.8	8.3	.19	60	500
4		c	$-2x10^{-7}$	100	.07		22.6	22.6	24.9	2.3	16.1	8.8	.21	120	1,100
5				600	.19		23.5	23.4	25.7	2.3	16.4	9.3	.20	170	1,600
6							24.2	24.5	26.6	2.1	16.8	9.8	.18	180	1,800
7							25.8	24.9	27.1	2.2	17.8	9.3	.19	150	1,400
8							24.8	25.6	27.7	2.1	19.3	8.4	.20	100	800
9							26.3	26.4	28.2	1.8	20.9	7.3	.20	50	400
10							28.2	27.2	28.6	1.4	22.2	6.4	.20	20	100
11							27.1	28.0	29.1	1.1	23.1	6.0	.15	0	0
12							28.7								
		IHNC									(6-Day Lag)			(6-Day Lag)	
1		R^2	.99	X	Y		22.5		22.5	0.0	15.5	7.0	.00	0	0
2		a	.002	0	.00		22.7	21.8	23.2	1.4	15.7	7.5	.16	50	400
3		b	$4x10^{-4}$	20	.01		20.1	21.2	23.8	2.6	16.3	7.5	.26	120	900
4		c	$-2x10^{-7}$	100	.04		20.7	20.8	24.5	3.7	16.4	8.1	.31	190	1,500
5				600	.21		21.7	21.9	25.2	3.3	16.6	8.6	.28	190	1,600
6							23.4	22.8	25.9	3.1	17.4	8.5	.27	150	1,300
7							23.3	23.4	26.3	2.9	19.3	7.0	.29	100	700
8							23.6	23.6	26.8	3.2	21.2	5.6	.36	40	200
9							24.0	25.0	27.3	2.3	22.3	5.0	.32	10	100
10							27.4	25.9	27.6	1.7	23.2	4.4	.28	0	0
11							26.2	26.9	28.0	1.1	23.8	4.2	.21	0	0
12							27.2								

TABLE [illegible]

COMPARATIVE ANALYSIS OF PARAMETER LEVELS DURING
1979 BONNET CARRE SPILLWAY OPERATIONS

LAKE PONTCHARTRAIN 9.7 MILES NNW OF KENNER

Interval	Date(s) (Each Station)	Parameter					OBS Lake	(1) ADJ	(2) (Ambient) EST Lake	(3) EST-ADJ (2) - (1)	(4) (OBS) BCS	(5) EST-OBS (2) - (4)	(6) Y Gradient Ratio (3)/(3) + (5)	(7) Discharge (1000 CFS)	(8) X Gradient Flux (5) X (7)
		Temperature (°C)									(24-Day Lag)			(24-Day Lag)	
1	Apr 16	R^2	.57	X	Y	Y_{ADJ}	(22.7)		2[illegible].7	0.0	15.5	7.2	-	0	0
2	[illegible]	a	.09	0	.09	.00	22.[illegible]	21.9	23.5	1.6	15.6	7.9	.17	0	0
3	[illegible]	b	$3x10^{-[illegible]}$	20	.09	.06	21.1	22.3	24.3	2.0	15.6	8.7	.19	10	100
4	May [illegible]	c	$-1x10^{-7}$	100	.11	.10	23.8	22.6	25.1	2.5	15.7	9.4	.21	30	300
5	[illegible]			600	.21		22.8	23.5	25.8	2.3	15.9	9.9	.19	70	700
6	[illegible]						23.9	23.6	26.7	3.1	16.2	10.5	.23	110	1200
7	[illegible]						24.6	24.0	27.2	3.2	16.6	10.6	.23	150	1600
8	23-[illegible]						24.0	24.5	27.8	3.3	17.2	10.6	.24	160	1700
9	Jun [illegible]						25.4	25.5	28.2	2.7	18.2	10.0	.21	140	1400
10	[illegible]						27.0	26.3	28.6	2.3	19.5	9.1	.20	100	900
11	[illegible]						26.6	27.4	29.1	1.7	20.9	8.2	.17	60	500
12	2[illegible]						(28.7)								
		Salinity (‰)									(24-Day-Lag)			(24-Day-Lag)	
		R^2	.61	X	Y	Y_{ADJ}	(0.8)		0.8	0.0	0.1	0.7	-	0	0
		a	.19	0	.19	.00	0.8	0.6	1.4	0.8	0.1	1.3	.38	0	0
		b	.01	5	.21	.15	0.3	0.5	1.4	0.9	0.1	1.3	.41	10	10
		c	$-2x10^{-5}$	20	.29	.27	0.5	0.3	1.3	1.0	0.1	1.2	.45	30	40
				120	.52	.51	0.2	0.3	1.2	0.9	0.1	1.1	.45	70	80
							0.2	0.2	1.2	1.0	0.1	1.1	.48	110	120
							0.2	0.2	1.2	1.0	0.1	1.1	.48	150	160
							0.2	0.2	1.2	1.0	0.1	1.1	.48	160	180
							0.1	0.2	1.1	0.9	0.1	1.0	.47	140	140
							0.2	0.2	1.2	1.0	0.1	1.1	.48	100	150
							0.3	0.4	1.2	0.8	0.1	1.1	.42	60	70
							(0.7)								

(6) Gradient [illegible]	(7) [illegible] Charge [illegible] (FS)	(8) A Gradient Flux (5) x (7)
(6-Day Lag)		
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3
[illegible]	[illegible]	[illegible]
.31	[illegible]	[illegible]
.37	[illegible]	13[illegible]
[illegible]	[illegible]	16[illegible]
.41	[illegible]	18[illegible]
.3[illegible]	[illegible]	17[illegible]
(12 Day Lag)		
[illegible]	[illegible]	[illegible]
.33	20	[illegible]
.33	[illegible]	40
[illegible]	[illegible]	70
.50	[illegible]	80
[illegible]	18[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
(18-Day Lag)		
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	30
[illegible]	[illegible]	80
[illegible]	[illegible]	160
[illegible]	120	320
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	360
[illegible]	[illegible]	260
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

TABLE H-8-28

PREDICTION OF WATER QUALITY PARAMETER LEVELS IN LAKE PONTCHARTRAIN WITH DESIGN DISCHARGE THROUGH PROPOSED FRESHWATER DIVERSION STRUCTURE

Parameter Susp. Residue (MG/L)

Condition 10% Exc. Miss R; 90% Exc. L. Pont

Month	6-Day Period	(1) Ambient Parameter Level	(2) Diversion Parameter Level-Lagged	(3) Parameter Gradient (2) - (1)	(4) Lagged Discharge (1000 cfs)	(5) Gradient Flux (3) x (4)	(6) Gradient Ratio (7)/(3) + (7)	(7) Predicted Parameter Gradient	(8) Predicted Parameter Level
Lake Pontchartrain @ Mid-Causeway (36-Day Lag)									
May	5	9	175	166	26	4,300	.01	2	11
Jun	1	6	184	178	25	4,500	.01	2	8
	2	4	195	191	22	3,800	.00	0	4
Lake Pontchartrain @ IHNC (6-Day Lag)									
Apr	2	0	185	185	24	4,400	.02	4	4
	3	0	172	172	30	5,200	.03	5	5
	4	0	163	163	30	4,900	.03	5	5

TABLE H-8-27

PREDICTION OF WATER QUALITY PARAMETER LEVELS IN LAKE PONTCHARTRAIN
WITH DESIGN DISCHARGE THROUGH PROPOSED FRESHWATER DIVERSION STRUCTURE

Parameter Temperature (^{o}C) Condition 90% Exc. Miss R; 10% Exc. L. Pont

Month	6-Day Period	(1) Ambient Parameter Level	(2) Diversion Parameter Level-Lagged	(3) Parameter Gradient (1) - (2)	(4) Lagged Discharge (1000 cfs)	(5) Gradient Flux (3) x (4)	(6) Gradient Ratio (7)/(3) + (7)	(7) Predicted Parameter Gradient	(8) Predicted Parameter Level
Lake Pontchartrain @ Mid-Causeway (30-Day Lag)									
Apr	2	23.7	4.5	19.2	9	173	.03	0.6	23.1
	3	24.3	6.4	17.9	11	197	.03	0.6	23.7
	4	24.8	7.6	17.4	14	244	.04	0.7	24.1
	5	25.3	9.0	16.3	18	293	.04	0.7	24.6
May	1	25.8	10.5	15.3	22	337	.05	0.8	25.0
	2	26.3	12.0	14.3	26	372	.06	0.9	25.4
	3	26.8	13.3	13.5	27	365	.06	0.9	25.9
Lake Pontchartrain @ Pass Manchac (12-Day Lag									
Apr	1	23.9	7.2	16.7	13	217	.10	1.9	22.0
	2	24.5	8.9	15.6	17	265	.12	2.1	22.4
	3	25.2	10.6	14.6	24	350	.13	2.2	23.0
	4	25.7	12.2	13.5	28	378	.14	2.2	23.5
	5	26.1	13.6	12.5	30	375	.14	2.2	23.9
Lake Pontchartrain @ IHNC (6-Day Lag)									
Apr	1	24.4	8.9	15.5	17	264	.09	1.5	22.9
	2	25.1	10.6	14.5	24	348	.11	1.8	23.3
	3	25.7	12.3	13.4	30	402	.13	2.2	23.5
	4	26.2	13.7	12.5	30	375	.12	1.7	24.5
	5	26.7	14.7	12.0	30	360	.12	1.6	25.1

TABLE H-8-26

PREDICTION OF WATER QUALITY PARAMETER LEVELS IN LAKE PONTCHARTRAIN
WITH DESIGN DISCHARGE THROUGH PROPOSED FRESHWATER DIVERSION STRUCTURE

Parameter Nitrate + Nitrite (MG/L) | Condition 10% Exc. Miss R; 90% Exc. L. Pont

Month	6-Day Period	(1) Ambient Parameter Level	(2) Diversion Parameter Level-Lagged	(3) Parameter Gradient (2) - (1)	(4) Lagged Discharge (1000 cfs)	(5) Gradient Flux (3) x (4)	(6) Gradient Ratio (7)/(3) + (7)	(7) Predicted Parameter Gradient	(8) Predicted Parameter Level
Lake Pontchartrain @ Mid-Causeway (36-Day Lag)									
May	3	.00	1.9	1.9	25	48	.06	.12	.12
	4	.00	2.0	2.0	27	54	.07	.15	.15
	5	.00	2.0	2.0	26	52	.07	.15	.15
Jun	1	.00	2.0	2.0	25	50	.07	.15	.15
	2	.00	2.0	2.0	22	44	.06	.13	.13
Lake Pontchartrain @ Pass Manchac (48-Day Lag)									
May	5	.03	1.9	1.9	24	46	.06	.12	.15
Jun	1	.03	2.0	2.0	26	52	.07	.15	.18
	2	.03	2.0	2.0	26	52	.07	.15	.18
	3	.03	2.0	2.0	24	48	.07	.15	.18
	4	.03	2.0	2.0	22	44	.06	.13	.16

TABLE H-8-25

PREDICTION OF WATER QUALITY PARAMETER LEVELS IN LAKE PONTCHARTRAIN
WITH DESIGN DISCHARGE THROUGH PROPOSED FRESHWATER DIVERSION STRUCTURE

Parameter Salinity ($^{o}/oo$) Condition 50% Exc. Miss R; 50% Exc. L. Pont

Month	6-Day Period	(1) Ambient Parameter Level	(2) Diversion Parameter Level-Lagged	(3) Parameter Gradient (1) - (2)	(4) Lagged Discharge (1000 cfs)	(5) Gradient Flux (3) x (4)	(6) Gradient Ratio (7)/(3) + (7)	(7) Predicted Parameter Gradient	(8) Predicted Parameter Level
Lake Pontchartrain @ Mid-Causeway (36-Day Lag)									
Apr	5	1.9	0.0	1.9	14	27	.12	0.3	1.6
May	1	1.9	0.0	1.9	18	34	.14	0.3	1.6
	2	1.8	0.0	1.8	22	40	.16	0.3	1.5
	3	1.7	0.0	1.7	25	42	.16	0.3	1.4
	4	1.7	0.0	1.7	27	46	.17	0.3	1.4
	5	1.7	0.0	1.7	26	44	.17	0.3	1.4
Jun	1	1.7	0.0	1.7	25	42	.16	0.3	1.4
Lake Pontchartrain @ Pass Manchac (12-Day Lag)									
Apr	4	0.6	0.0	0.6	28	17	.23	0.2	0.4
	5	0.7	0.0	0.7	30	21	.26	0.2	0.5
May	1	0.7	0.0	0.7	29	20	.25	0.2	0.5
	2	0.8	0.0	0.8	26	21	.26	0.3	0.5
Lake Pontchartrain @ IHNC (18-Day Lag)									
Apr	5	2.8	0.0	2.8	27	76	.35	1.5	1.3
May	1	2.8	0.0	2.8	29	81	.36	1.6	1.2
	2	2.7	0.0	2.7	28	76	.35	1.5	1.2

TABLE H-8-24

PREDICTION OF WATER QUALITY PARAMETER LEVELS IN LAKE PONTCHARTRAIN
WITH DESIGN DISCHARGE THROUGH PROPOSED FRESHWATER DIVERSION STRUCTURE

Parameter Turbidity (JTU) Condition 50% Exc. Miss R; 50% Exc. L. Pont

Month	6-Day Period	(1) Ambient Parameter Level	(2) Diversion Parameter Level-Lagged	(3) Parameter Gradient (1) - (2)	(4) Lagged Discharge (1000 cfs)	(5) Gradient Flux (3) x (4)	(6) Gradient Ratio (7)/(3) + (7)	(7) Predicted Parameter Gradient	(8) Predicted Parameter Level
Lake Pontchartrain @ Mid-Causeway (36-Day Lag)									
Apr	5	14	74	60	14	800	.00	0	14
May	1	13	76	63	18	1,100	.00	0	13
	2	13	78	65	22	1,400	.00	0	13
	3	12	79	67	25	1,700	.01	1	13
	4	11	79	68	27	1,800	.01	1	12
	5	10	79	69	26	1,800	.01	1	11
Jun	1	9	78	69	25	1,700	.01	1	10
Lake Pontchartrain @ Pass Manchac (0-Day Lag)									
Apr	1	20	78	58	30	1,700	.02	1	21
	2	19	80	61	30	1,800	.02	1	20
	3	18	83	65	30	1,900	.02	1	19
	4	17	80	63	30	1,900	.02	1	18
	5	16	78	62	30	1,900	.02	1	17
Lake Pontchartrain @ IHNC (6-Day Lag)									
Apr	1	12	76	64	17	1,100	.03	2	14
	2	12	78	66	24	1,600	.04	3	15
	3	12	80	68	30	2,000	.05	4	16
	4	12	81	69	30	2,000	.05	4	16
	5	11	80	69	30	2,000	.05	4	15

TABLE H-8-23

PREDICTION OF WATER QUALITY PARAMETER LEVELS IN LAKE PONTCHARTRAIN
WITH DESIGN DISCHARGE THROUGH PROPOSED FRESHWATER DIVERSION STRUCTURE

Parameter Phosphorus,Total (MG/L) Condition 50% Exc. Miss R; 50% Exc. L. Pont.

Month	6-Day Period	(1) Ambient Parameter Level	(2) Diversion Parameter Level-Lagged	(3) Parameter Gradient (1) - (2)	(4) Lagged Discharge (1000 cfs)	(5) Gradient Flux (3) x (4)	(6) Gradient Ratio (7)/(3) + (7)	(7) Predicted Parameter Gradient	(8) Predicted Parameter Level
Lake Pontchartrain @ Mid-Causeway (48-Day Lag)									
May	5	.06	.27	.21	24	5.0	.03	.01	.07
Jun	1	.05	.27	.22	26	5.7	.04	.01	.06
	2	.05	.26	.21	26	5.5	.03	.01	.06
	3	.05	.25	.20	24	4.8	.03	.01	.06
	4	.05	.25	.20	22	4.4	.02	.00	.05
Lake Pontchartrain @ Pass Manchac (18-Day Lag)									
Apr	5	.05	.27	.22	27	5.9	.22	.06	.11
May	1	.05	.27	.22	29	6.4	.22	.06	.11
	2	.06	.26	.20	28	5.6	.22	.06	.12
	3	.07	.25	.18	25	4.5	.20	.05	.12
	4	.07	.25	.18	22	4.0	.20	.05	.12
Lake Pontchartrain @ IHNC (0-Day Lag)									
Apr	2	.07	.27	.20	30	6.0	.09	.02	.09
	3	.07	.27	.20	30	6.0	.09	.02	.09
	4	.07	.26	.19	30	5.7	.09	.02	.09
	5	.07	.25	.18	30	5.4	.08	.02	.09

TABLE H-8-22

PREDICTION OF WATER QUALITY PARAMETER LEVELS IN LAKE PONTCHARTRAIN
WITH DESIGN DISCHARGE THROUGH PROPOSED FRESHWATER DIVERSION STRUCTURE

Parameter Susp. Residue (MG/L) Condition 50% Exc. Miss R; 50% Exc. L. Pont

Month	6-Day Period	(1) Ambient Parameter Level	(2) Diversion Parameter Level-Lagged	(3) Parameter Gradient (2) - (1)	(4) Lagged Discharge (1000 cfs)	(5) Gradient Flux (3) x (4)	(6) Gradient Ratio (7)/(3) + (7)	(7) Predicted Parameter Gradient	(8) Predicted Parameter Level
Lake Pontchartrain @ Mid-Causeway (36-Day Lag)									
May	5	25	114	89	26	2,300	.00	.00	25
Jun	1	21	116	95	25	2,400	.00	.00	21
	2	18	116	98	22	2,200	.00	.00	18
	3	15	116	101	20	2,000	.00	.00	15
	4	15	113	98	18	1,800	.00	.00	15
Lake Pontchartrain @ IHNC (6-Day Lag)									
Apr	4	13	112	99	30	3,000	.02	2	15
	5	13	114	101	30	3,000	.02	2	15
May	1	12	116	104	26	2,700	.01	1	13

TABLE H-8-21

PREDICTION OF WATER QUALITY PARAMETER LEVELS IN LAKE PONTCHARTRAIN
WITH DESIGN DISCHARGE THROUGH PROPOSED FRESHWATER DIVERSION STRUCTURE

Parameter Temperature (°C)

Condition 50% Exc. Miss R; 50% Exc. L. Pont

Month	6-Day Period	(1) Ambient Parameter Level	(2) Diversion Parameter Level-Lagged	(3) Parameter Gradient (1) - (2)	(4) Lagged Discharge (1000 cfs)	(5) Gradient Flux (3) x (4)	(6) Gradient Ratio (7)/(3) + (7)	(7) Predicted Parameter Gradient	(8) Predicted Parameter Level
May	1 1/	23.4	13.4	10.0	22	220	.03	0.3	23.1
	2	24.1	14.2	9.9	26	260	.04	0.4	23.7
	3	24.8	15.1	9.7	27	260	.04	0.4	24.4
Lake Pontchartrain @ Pass Manchac (12-Day Lag)									
Apr	3	22.0	13.4	8.6	24	210	.10	1.0	21.0
	4	22.6	14.2	8.4	28	240	.11	1.0	21.6
	5	23.3	15.1	8.2	30	250	.11	1.0	22.3
Lake Pontchartrain @ IHNC (6-Day Lag)									
Apr	2	21.6	13.4	8.2	24	200	.07	0.6	21.0
	3	22.4	14.2	8.2	30	250	.08	0.7	21.7
	4	22.9	15.1	7.8	30	230	.08	0.7	22.2

1/ Lake Pontchartrain @ Mid Causeway (30-day lag).

TABLE H-8-20

PREDICTION OF WATER QUALITY PARAMETER LEVELS IN LAKE PONTCHARTRAIN WITH DESIGN DISCHARGE THROUGH PROPOSED FRESHWATER DIVERSION STRUCTURE

Parameter Nitrate + Nitrite (MG/L) Condition 50% Exc. Miss R; 50% Exc. L. Pont.

Month	6-Day Period	(1) Ambient Parameter Level	(2) Diversion Parameter Level-Lagged	(3) Parameter Gradient (2) - (1)	(4) Lagged Discharge (1000 cfs)	(5) Gradient Flux (3) x (4)	(6) Gradient Ratio (7)/(3) + (7)	(7) Predicted Parameter Gradient	(8) Predicted Parameter Level
Lake Pont. @ Mid-Causeway (36-Day Lag)									
May	4	.08	1.3	1.2	27	32	.05	.06	.14
	5	.08	1.4	1.3	26	34	.05	.07	.15
Jun	1	.07	1.5	1.4	25	35	.05	.07	.14
	2	.07	1.5	1.4	22	31	.04	.06	.13
	3	.07	1.6	1.5	20	30	.04	.06	.13
Lake Pont. @ Pass Manchac (48-Day Lag)									
Jun	1	.11	1.3	1.2	26	31	.03	.04	.15
	2	.11	1.4	1.3	26	34	.04	.05	.16
	3	.11	1.5	1.4	24	34	.04	.06	.17
	4	.11	1.5	1.4	22	31	.03	.04	.15
	5	.11	1.6	1.5	20	30	.03	.05	.16

maximum departure from ambient are shown without specification of what the ambient level would have been at the time of maximum change. Tables H-8-20 through H-8-31 illustrate the stepwise procedure of successive application of the gradient ratio-gradient flux relationships to ambient lake and diversion water parameter levels for six-day time periods. Average response times of from zero to eight periods were simulated by lagging and attenuating both flow rates and parameter levels in diversion water before application to lake parameter levels. Two hypothetical sets of conditions were chosen for the determination of parameter level changes and assessment of potential impacts- a normal lake-normal river condition, and a somewhat extreme combination which would be exceeded less than 10 percent of the time. Tables H-8-3 through H-8-5 contain Lake Pontchartrain parameter level-exceedence probability data at each of the three primary stations, and Table H-8-32 contains Mississippi River parameter level-probability data composited from five monitoring stations.

H.8.27. Since potential impacts of diversion would be greatest in the months of April, May, and June, the response times as derived from analysis of the 1979 Bonnet Carre' diversion, which occurred in those months, is considered to be indicative of the general response patterns that would occur under project conditions. High gradients, or differences between diversion water and lake water parameter levels, would be of less importance later in the calendar year because of significantly lower anticipated supplemental flow requirements, and because species sensitive to the project-induced changes would already have been impacted during the earlier diversion months, and would have responded according to the altered conditions.

H.8.28. Although certain degrees of reliability may be achieved for parameter level change predictions, the significance of those changes on the ecosystem in general, or in particular, is often difficult to

TABLE H-8-19

PREDICTED CHANGES IN WATER QUALITY PARAMETER
LEVELS IN LAKE PONTCHARTRAIN DURING DIVERSION STRUCTURE OPERATIONS

Note: Percentage Figures Represent Exceedence Probabilities For River And Lake, Respectively, Except For Temperature And Salinity, Which Are Reversed.

Lake Pont. Location		Mid-Causeway				Mouth of Pass Manchac				10 Mi NNW of Kenner				Entrance of IHNC			
Parameter		Amb. (50 - 50%)	Pred.	Amb. (10 - 90%)	Pred.	Amb. (50 - 50%)	Pred.	Amb. (10 - 90%)	Pred.	Amb. (50 - 50%)	Pred.	Amb. (10 - 90%)	Pred.	Amb. (50 - 50%)	Pred.	Amb. (10 - 90%)	Pred.
Nitrate + Nitrite (MG/L)	Mean Apr	.05		.00	.04	.23		.14	.15	.20		.12		.13		.07	
	Mean May	.07		.00	.12	.14		.04	.11	.12		.03		.08		.03	
	Mean Jun	.07		.00	.13	.11		.03	.17	.09		.03		.04		.01	
	Max. Diff.	.07 -	.14	.00 -	.15	.11 -	.17	.03 -	.18	.09 -	.56	.03 -	1.02	(Δ=.23)		(Δ=.49)	
Diversion Water Value		1.5		2.0		1.5		2.0		1.5		2.0		1.5		2.0	
Temperature (°C)	Mean Apr	21.3		24.3	21.7	21.9		25.1	23.1	21.2		24.1		22.1		25.7	23.9
	Mean May	24.7		26.7	24.7	25.0		27.4	26.1	24.8		27.3		25.0		28.2	27.2
	Mean Jun	27.2		27.6	27.2	27.3		28.5	27.9	27.4		28.8		27.1		28.1	27.8
	Max. Diff.	24.1	-23.7	26.3 -	25.4	22.6 -	21.6	25.7 -	23.5	24.2-	22.6	26.0	23.2	22.4 -	21.7	25.7 -	23.5
Diversion Water Value		14.2		7.6		14.2		12.2		15.1		12.1		14.2		12.3	
Suspended Solids Residue@ 105 °C (MG/L)	Mean Apr	26		5	5	13		0		13		0		14		0	4
	Mean May	27		11	12	11		0		11		0		11		0	5
	Mean Jun	18		3	4	15		0		13		0		10		0	3
	Max. Diff.	21	21	9	11	(Δ=2)		(Δ=5)		12	17	0	16	13	15	0	5
Diversion Water Value		116		175		116		180		116		185		114		172	
Fecal Coliform (MPN/100 ML)	Mean Apr	19		9		22		0		75		2		181		5	
	Mean May	30		12		8		0		14		0		27		0	
	Mean Jun	60		16		11		0		15		0		24		0	
	Max. Diff.	(Δ=1)		(Δ=5)		(Δ=5)		(Δ=24)		(Δ=13)		(Δ=69)		(Δ=10)		(Δ=52)	
Diversion Water Value		550		2900		550		2900		550		2900		550		2900	
Total Phosphorus (MG/L)	Mean Apr	.06		.03	.03	.04		.00	.10	.05		.01		.07		.04	
	Mean May	.06		.04	.05	.06		.00	.11	.06		.01		.06		.04	
	Mean Jun	.05		.02	.05	.08		.02	.12	.08		.02		.07		.03	
	Max. Diff.	.05 -	.06	.04 -	.07	.05 -	.11	.00 -	.12	.07 -	.15	.02 -	.24	.07 -	.09	.04-	.19
Diversion Water Value		.27		.39		.27		.39		.27		.39		.27		.39	
Total Copper (UG/L)	Mean Apr	4.0		1.0		5.8		2.8		5.2		2.6		4.0		2.2	
	Mean May	4.4		1.3		4.9		1.9		4.8		2.2		4.5		2.8	
	Mean Jun	4.1		1.8		4.4		1.5		4.5		2.0		4.7		3.1	
	Max. Diff.	(Δ=0.2)		(Δ=1.9)		(Δ=0.1)		(Δ=3.1)	5.1	5.2	5.2	2.6		(Δ=0.2)		(Δ=2.1)	
Diversion Water Value		7		19		7		19		7		19		7		19	
Turbidity (JTU)	Mean Apr	14		3	5	18		1	8	16		2		12		3	19
	Mean May	12		3	5	15		0	3	13		1		9		3	10
	Mean Jun	7		1	2	14		0	1	11		0		6		1	4
	Max. Diff.	10	- 11	3	- 7	18	- 19	2	- 15	16	- 20	2	- 28	12	- 16	2	- 23
Diversion Water Value		79		176		83		174		83		174		81		174	
Salinity (°/oo)	Mean Apr	2.1		3.4	2.8	0.6		1.6	0.8	1.4		2.8		2.9		3.9	1.8
	Mean May	1.8		3.1	2.1	0.7		1.7	0.9	1.5		2.9		2.8		3.8	1.5
	Mean Jun	1.7		3.2	2.3	0.7		1.6	1.0	1.8		2.7		3.0		4.2	2.1
	Max. Diff.	1.7 -	1.4	3.1-	2.0	0.8	0.5	1.7 -	0.8	1.6 -	0.6	2.9 -	0.4	2.8 -	1.2	3.8 -	1.2
Diversion Water Value		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	

TABLE H-8-18

COMPARATIVE ANALYSIS OF PARAMETER LEVELS DURING
1979 BONNET CARRE SPILLWAY OPERATIONS

PARAMETER TURBIDITY (JTU)

Interval	Date(s) (Each Station)	Lake Pontchartrain Station		X	Y	OBS	(1) ADJ Lake	(2) (Ambient) EST Lake	(3) ADJ-EST (1) - (2)	(4) (OBS) BCS	(5) OBS - EST (4) - (2)	(6) Y Gradient Ratio (3)/(3) + (5)	(7) Discharge (1000 CFS)	(8) X Gradient Flux (5) X (7)
		Mid-Causeway								(24-Day Lag)			(24-Day Lag)	
1	Apr 16	R^2	1.00	X	Y	15		15	0	60	45	.00	0	0
2	19-24	a	.001	0	.00	15	15	13	2	81	68	.03	0	0
3	25-29	b	$-1x10^{-6}$	200	.00	16	14	11	3	95	84	.03	0	0
4	May 30-5	c	$2x10^{-9}$	1,000	.00	10	11	9	2	102	93	.02	0	0
5	6-10			3,000	.01	7	8	7	1	104	97	.01	20	2,000
6	11-17			7,000	.08	8	10	8	2	105	97	.02	40	4,000
7	18-22					15	17	8	9	105	97	.08	70	7,000
8	23-30					29	33	7	26	103	96	.21	110	11,000
9	Jun 1-4					55	36	7	29	99	92	.24	130	12,000
10	5-9					23	29	6	23	93	87	.21	140	12,000
11	10-14					9	14	6	8	86	80	.09	130	10,000
12	Jun 25					9								
		Pass Manchac								(0-Day Lag)			(0-Day Lag)	
1		R^2	1.00	X	Y	9		9	0	106	97	.00	0	0
2		a	.00	0	.00	47	26	11	15	106	95	.14	150	14,000
3		b	$1x10^{-5}$	200	.00	23	32	12	20	111	99	.17	220	22,000
4		c	$-3x10^{-10}$	1,000	.01	25	21	13	8	89	76	0.10	200	17,000
5				3,000	.04	14	18	14	4	92	78	.05	160	12,000
6				7,000	.08	16	16	16	0	82	66	.00	100	7,000
7						18	18	14	4	71	57	.07	30	2,000
8						21	17	12	5	52	40	.11	0	0
9						11	14	11	3	29	18	.14	0	0
10						10	14	10	4	18	8	.33	0	0
11						22	18	17	1	69	52	.02	0	0
12						21								
		IHNC								(6-Day Lag)			(6-Day Lag)	
1		R^2	1.00	X	Y	7		7	0	71	64	.00	0	0
2		a	$-2x10^{-4}$	0	.00	27	26	12	14	106	94	.13	50	5,000
3		b	$3x10^{-5}$	200	.01	45	43	16	27	108	92	.23	120	11,000
4		c	$-9x10^{-10}$	1,000	.03	56	50	21	29	102	81	.26	190	15,000
5				3,000	.08	48	45	26	19	97	71	.21	190	13,000
6				7,000	.17	31	37	31	6	88	57	.10	150	8,000
7						32	27	25	2	82	57	.03	100	6,000
8						19	20	14	6	68	54	.10	40	2,000
9						8	11	8	3	51	43	.07	10	0
10						6	9	6	3	33	27	.10	0	0
11						13	10	13	-3	39	26	-.10	0	0
12						12								

TABLE B-8-17

COMPARATIVE ANALYSIS OF PARAMETER LEVELS DURING 1979 BONNET CARRE SPILLWAY OPERATIONS

PARAMETER SUSPENDED RESIDUE (MG/L)

Interval	Date(s) (Each Station)	Lake Pontchartrain Station			OBS Lake	(1) ADJ Lake	(2) (Ambient) EST Lake	(3) ADJ-EST (1) - (2)	(4) (OBS) BCS	(5) OBS-EST (4) - (2)	(6) Y Gradient Ratio (3)/(4) + (5)	(7) Discharge (1000 CFS)	(8) X Gradient Flux (6) X (7)
		Mid-Causeway							(36-Day Lag)			(36-Day Lag)	
1	Apr 16	R^2 .99	X	Y	31		31	0	133	102	-	0	0
2	19-24	a -.001	0	.00	27	25	24	1	177	153	.01	0	0
3	25-29	b $7x10^{-7}$	200	.00	18	19	18	1	204	186	.01	0	0
4	May 30-05	c $2x10^{-10}$	1,000	.00	12	13	12	1	214	202	.00	0	0
5	06-10		2,000	.00	9	9	9	0	220	211	.00	20	4,000
6	11-17		5,000	.01	6	10	6	4	212	206	.02	40	8,000
7	18-22				16	18	6	12	242	236	.05	70	17,000
8	23-30				33	34	7	27	223	216	.11	110	24,000
9	Jun 01-04				54	35	7	28	197	190	.13	130	25,000
10	05-09				17	27	8	19	167	159	.11	140	22,000
11	10-14				10	12	8	4	135	127	.03	130	17,000
12	Jun 25				10								
		Pass Manchac							(0-Day Lag)			(0-Day Lag)	
1			X	Y	54		54	0	269	215	-	0	0
2			0	.00	71	55	40	15	269	229	.06	150	34,000
3			200	.00	39	42	29	13	185	156	.08	220	34,000
4			1,000	.00	15	22	15	7	182	167	.04	200	33,000
5			2,000	.00	13	11	13	-2	130	117	-.02	160	10,000
6			5,000	.00	6	10	6	4	90	83	.05	100	8,000
7					11	13	7	6	58	51	.11	30	2,000
8					22	15	9	6	52	43	.12	0	0
9					13	16	11	5	15	4	.56	0	0
10					12	17	12	5	28	16	.24	0	0
11					27	22	18	4	84	66	.06	0	0
12					27								
		IHNC							(6-Day Lag)			(6-Day Lag)	
1		R^2 .99	X	Y	7	7	7	0	179	172	-	0	0
2		a $-3x10^{-3}$	0	.00	41	27	7	20	269	262	.07	50	13,000
3		b $8x10^{-6}$	200	.00	34	39	6	33	227	221	.13	120	27,000
4		c $1x10^{-10}$	1,000	.00	42	36	6	30	212	206	.13	190	39,000
5			2,000	.01	32	32	6	26	66	60	.14	190	30,000
6			5,000	.03	22	29	5	24	134	129	.16	150	19,000
7					34	23	5	18	93	88	.17	100	9,000
8					14	19	5	14	67	62	.18	40	2,000
9					8	9	5	4	42	37	.10	10	[illegible]
10					5	10	5	5	32	27	.16	0	0
11					18	13	5	8	43	38	.17	0	[illegible]
12					16								

TABLE H-8-16

COMPARATIVE ANALYSIS OF PARAMETER LEVELS DURING
1979 BONNET CARRE' SPILLWAY OPERATIONS

PARAMETER
COPPER, TOTAL (UG/L)

Interval	Date (Each Station)	Lake Pontchartrain Station	(1) OBS Lake	(1) ADJ Lake	(2) (Ambient) EST Lake	(3) ADJ - EST (1) - (2)	(4) OBS BCS	(5) OBS - EST (4) - (2)	(6) Y Gradient Ratio (3)/(3) + (5)	(7) Discharge (1000 CFS)	(8) X Gradient Flux (5) x (7)
		Mid-Causeway					(30-Day Lag)			(30-Day Lag)	
1	Apr 16	R^2 .99 X Y	8.0		8.0	0.0	6.9	-1.1	.00	0	0
2	19-24	a -.002 0 .00	8.2	9.3	6.2	3.1	9.3	3.1	.50	0	0
3	25-29	b $3x10^{-4}$ 50 .01	11.6	7.6	4.8	2.8	10.6	5.8	.33	0	0
4	May 30-05	c $3x10^{-7}$ 200 .07	3.0	7.3	3.0	4.3	11.3	8.3	.34	10	80
5	06-10	1,000 .59	7.2	4.6	3.7	0.9	11.2	7.5	.11	40	300
6	11-17		3.6	6.5	3.6	2.9	11.4	7.8	.27	70	550
7	18-22		8.8	8.0	3.7	4.3	10.6	6.9	.38	110	760
8	23-30		11.6	8.3	3.8	4.5	9.5	5.7	.44	140	800
9	Jun 01-04		4.6	6.7	3.9	2.8	8.6	4.7	.37	150	700
10	05-09		4.0	4.5	4.0	0.5	7.9	3.9	.11	130	510
11	10-14		4.8	4.4	4.8	-0.4	7.7	2.9	-.12	100	290
12	25		4.3								
		Pass Manchac					(0-Day Lag)			(0-Day Lag)	
1		R^2 .97 X Y Y_{ADJ}	8.0		8.0	0.0	12.0	4.0	.00	0	0
2		a .04 0 .04 .02	6.2	11.8	5.7	6.1	12.0	6.3	.49	150	950
3		b $9x10^{-4}$ 50 .08 .07	21.2	9.9	3.7	6.2	11.4	7.7	.45	220	1,690
4		c $-4x10^{-7}$ 200 .20	2.4	8.9	2.4	6.5	5.2	2.8	.70	200	560
5		1,000 .53	3.0	3.7	3.0	0.7	5.8	2.8	.20	160	450
6			5.6	4.3	5.6	-1.3	7.2	1.6	.45	100	160
7			4.2	5.7	4.2	1.5	11.8	7.6	.16	30	230
8			7.2	5.0	3.8	1.2	5.3	2.0	.38	0	0
9			3.6	5.5	3.6	1.9	6.4	2.8	.40	0	0
10			5.6	4.6	4.1	0.5	4.6	0.5	.50	0	0
11			4.6	4.9	4.6	0.3	5.6	1.0	.23	0	0
12			4.5								
								Added X,Y Values	.24		200
									.35		400
		IPNC					(0-Day Lag)			(0-Day Lag)	
1		R^2 1.00 X Y	6.0		6.0	0.0	12.0	6.0	.00	0	0
2		a $-3x10^{-4}$ 0 .00	8.2	9.4	5.2	4.2	12.0	6.8	.38	150	1,020
3		b $6x10^{-4}$ 50 .03	14.0	8.6	4.4	4.2	11.4	7.0	.38	220	1,540
4		c $-2x10^{-7}$ 200 .11	3.6	7.6	3.6	4.0	[illegible]	1.6	.71	200	320
5		1,000 .34	5.2	4.5	4.1	0.4	[illegible]	1.7	.19	[illegible]	270
6			4.8	5.1	4.7	0.4	[illegible]	2.5	.14	100	250
7			5.4	[illegible]	4.4	1.5	[illegible]	7.4	.17	30	220
8			7.6	5.6	4.1	1.5	5.8	[illegible]	.47	0	0
9			[illegible]	[illegible]	3.8	[illegible]	[illegible]	2.6	.37	[illegible]	0
10			4.6	[illegible]	4.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0
11			[illegible]	[illegible]	[illegible]	[illegible]	5.6	1.0	.00	[illegible]	0
12			[illegible]								

TABLE H-8-29

PREDICTION OF WATER QUALITY PARAMETER LEVELS IN LAKE PONTCHARTRAIN
WITH DESIGN DISCHARGE THROUGH PROPOSED FRESHWATER DIVERSION STRUCTURE

Parameter Phosphorus, Total (MG/L) Condition 10% Exc. Miss R; 90% Exc. L. Pont

Month	6-Day Period	(1) Ambient Parameter Level	(2) Diversion Parameter Level-Lagged	(3) Parameter Gradient (2) - (1)	(4) Lagged Discharge (1000 cfs)	(5) Gradient Flux (3) x (4)	(6) Gradient Ratio (7)/(3) + (7)	(7) Predicted Parameter Gradient	(8) Predicted Parameter Level
Lake Pontchartrain @ Mid-Causeway (48-Day Lag)									
May	5	.03	.38	.35	24	8.4	.08	.03	.06
Jun	1	.03	.39	.36	26	9.4	.09	.04	.07
	2	.02	.39	.37	26	9.6	.09	.04	.06
	3	.02	.39	.37	24	8.9	.08	.02	.04
	4	.02	.38	.36	22	7.9	.07	.03	.05
Lake Pontchartrain @ Pass Manchac (18-Day Lag)									
Apr	5	.00	.38	.38	27	10.3	.23	.11	.11
May	1	.00	.39	.39	29	11.3	.23	.12	.12
	2	.00	.39	.39	28	10.9	.23	.12	.12
	3	.00	.39	.39	25	9.8	.23	.12	.12
	4	.00	.38	.38	22	8.4	.22	.11	.11
Lake Pontchartrain @ IHNC (0-Day Lag)									
Apr	3	.04	.39	.35	30	11.0	.15	.15	.19
	4	.04	.39	.35	30	11.0	.15	.15	.19
	5	.04	.39	.35	30	11.0	.15	.15	.19

TABLE H-8-30

PREDICTION OF WATER QUALITY PARAMETER LEVELS IN LAKE PONTCHARTRAIN
WITH DESIGN DISCHARGE THROUGH PROPOSED FRESHWATER DIVERSION STRUCTURE

Parameter Turbidity (JTU) | Condition 10% Exc. Miss R; 90% Exc. L. Pont

Month	6-Day Period	(1) Ambient Parameter Level	(2) Diversion Parameter Level-Lagged	(3) Parameter Gradient (2) - (1)	(4) Lagged Discharge (1000 cfs)	(5) Gradient Flux (3) x (4)	(6) Gradient Ratio (7)/(3) + (7)	(7) Predicted Parameter Gradient	(8) Predicted Parameter Level
Lake Pontchartrain @ Mid-Causeway (36-Day Lag)									
May	1	3	194	191	18	3,400	.01	2	5
	2	3	176	173	22	3,800	.02	4	7
	3	3	157	154	25	3,300	.01	2	5
Lake Pontchartrain @ Pass Manchac (0-Day Lag)									
Apr	1	2	174	172	30	5,200	.07	13	15
	2	1	147	146	30	4,400	.06	9	10
	3	0	121	121	30	3,600	.05	6	6
Lake Pontchartrain @ IHNC (6-Day Lag)									
Apr	1	2	200	198	17	2,500	.07	15	17
	2	2	174	172	21	4,100	.11	21	23
	3	3	147	144	30	4,300	.11	18	21

TABLE H-8-31

PREDICTION OF WATER QUALITY PARAMETER LEVELS IN LAKE PONTCHARTRAIN
WITH DESIGN DISCHARGE THROUGH PROPOSED FRESHWATER DIVERSION STRUCTURE

Parameter Salinity (^{o}/oo) Condition 90% Exc. Miss R; 10% Exc. L. Pont

Month	6-Day Period	(1) Ambient Parameter Level	(2) Diversion Parameter Level-Lagged	(3) Parameter Gradient (1) - (2)	(4) Lagged Discharge (1000 cfs)	(5) Gradient Flux (3) x (4)	(6) Gradient Ratio (7)/(3) + (7)	(7) Predicted Parameter Gradient	(8) Predicted Parameter Level
Lake Pontchartrain @ Mid-Causeway (36-Day Lag)									
May	3	3.0	.0	3.0	25	75	.25	1.0	2.0
	4	3.0	.0	3.0	27	81	.27	1.1	1.9
	5	3.1	.0	3.1	26	81	.27	1.1	2.0
Jun	1	3.1	.0	3.1	25	77	.26	1.1	2.0
	2	3.2	.0	3.2	22	70	.24	1.0	2.2
Lake Pontchartrain @ Pass Manchac (12-Day Lag)									
Apr	3	1.6	.0	1.6	24	38	.32	0.8	0.8
	4	1.6	.0	1.6	28	45	.33	0.8	0.8
	5	1.7	.0	1.7	30	51	.35	0.9	0.8
May	1	1.7	.0	1.7	29	16	.35	0.9	0.8
	2	1.8	.0	1.8	26	17	.34	0.9	0.9
Lake Pontchartrain @ IHNC (18-Day Lag)									
Apr	4	3.9	.0	3.9	23	90	.37	2.3	1.6
	5	3.8	.0	3.8	27	103	.40	2.5	1.3
May	1	3.8	.0	3.8	29	110	.41	2.6	1.2
	2	3.7	.0	3.7	28	104	.40	2.5	1.2
	3	3.7	.0	3.7	25	93	.38	2.3	1.4

TABLE H-8-32

PREDICTED PARAMETER LEVELS - MISSISSIPPI RIVER

Exceed. Prob. %		SAL (°/oo)	TEMP (°C)	TURB (JTU)	RSS (MG/L)	NIT (MG/L)	PHOS (MG/L)	COD (UG/L)	FCOL (MPN/100 ML)
	January								
10		0.1	8.5	110	256	1.80	.38	22.0	1,100
50		0.0	6.0	65	170	1.10	.28	12.0	420
90		0.0	4.0	25	36	.70	.12	3.0	80
	February								
10		0.1	10.5	130	286	1.30	.35	29.0	1,500
50		0.0	7.5	60	173	1.10	.24	6.0	320
90		0.0	3.5	15	69	.52	.04	0.0	100
	March								
10		0.1	14.5	230	300	1.60	.32	37.0	2,000
50		0.0	11.0	65	156	1.20	.25	12.0	750
90		0.0	5.5	40	83	1.00	.11	6.0	120
	April								
10		0.1	18.0	110	310	2.00	.39	38.0	4,200
50		0.0	15.0	75	160	1.30	.27	13.0	420
90		0.0	14.0	60	76	1.10	.18	6.0	160
	May								
10		0.1	23.0	110	332	2.00	.38	26.0	2,000
50		0.0	20.5	65	175	1.70	.23	14.0	500
90		0.0	17.5	55	84	.95	.14	0.0	190
	June								
10		0.1	27.0	65	259	1.80	.39	32.0	1,800
50		0.1	25.0	45	107	1.40	.22	13.0	400
90		0.0	22.5	15	53	1.20	.16	4.0	130
	July								
10		0.1	32.0	85	194	2.50	.43	50.0	4,200
50		0.1	29.0	55	104	1.70	.25	11.0	760
90		0.0	27.5	25	32	.92	.17	5.0	130
	August								
10		0.2	30.0	75	175	1.60	.29	30.0	2,000
50		0.1	29.0	30	64	1.30	.24	15.0	400
90		0.0	28.0	8	1	.63	.15	0.0	60
	September								
10		0.2	29.5	35	55	1.70	.36	29.0	3,900
50		0.1	28.5	15	23	1.00	.21	12.0	360
90		0.1	26.0	4	8	.23	.12	4.0	25
	October								
10		0.2	26.5	80	287	1.30	.36	24.0	3,500
50		0.1	21.5	25	43	1.10	.24	18.0	560
90		0.1	20.0	8	14	.38	.10	3.0	100
	November								
10		0.2	19.5	90	301	1.60	.31	52.0	3,500
50		0.1	17.0	35	100	.85	.21	12.0	1,000
90		0.0	15.0	15	22	.67	.10	4.0	140
	December								
10		0.1	13.0	130	427	1.40	.41	28.0	3,300
50		0.1	10.5	50	193	.95	.25	13.0	800
90		0.0	9.0	[illegible]	[illegible]	.69	.13	2.0	[illegible]

assess. Many physicochemical and biochemical processes occur in nature which provide for gradual adjustments to such changes. The longer the time periods over which meaningful parameter level changes occur, and the greater the degree of uniformity of the constituent levels in diversion water over time, the greater the likelihood of ecosystem adaptation without severe stress to its components.

IMPACT DISCUSSION-GENERAL PARAMETERS AND NUTRIENTS

H.8.29. The Mississippi River characteristically exhibits good DO/BOD ratios. DO usually exceeds BOD by a factor of three or more throughout the year. The weighted average incoming DO and BOD levels during a typical diversion season would be equivalent to ambient receiving water levels, about 8 and 2 mg/L, respectively. Incoming COD would average about 22 mg/L during a project design year, or about one-half the mean level in southwestern Lake Pontchartrain. Thus, from an oxidation standpoint, the diversion of river water would appear to be beneficial. Surface reareation would also be enhanced.

H.8.30. Two primary nutrients, nitrate plus nitrite and total phosphorus were statistically analyzed at the primary lake stations. Inorganic nitrogen tends to be higher in concentration at the Pass Manchac station, especially during high runoff months, while phosphorus is somewhat higher in concentration at the IHNC station, near urban pollution sources. Table H-8-19 indicates that maximal increases of nitrate and nitrite of about .07, .06, and .23 mg/L would occur at Mid-Causeway, Pass Manchac and IHNC with about a 0.47 mg/L rise occurring at the 10-mile distant location during a typical project design diversion season. These changes are within the ranges of variation experienced during about 50 percent of the years at the primary stations. Immediate nearshore areas would probably increase by up to about 1.0 mg/L. By comparison, the 1979 Bonnet Carre' operational period produced rises of

about .25 mg/L at mid-lake and about 1.50 mg/L at the 10-mile location (see tables H-8-9 and H-8-10). Normal ambient concentrations of about .04 to .11 mg/L are present at the four locations during the estimated time of peak change, in June, and the corresponding normal condition diversion water level would be about 1.5 mg/L. About 10,000 tons of nitrate plus nitrite would be added to Lake Pontchartrain during a typical diversion year.

H.8.31. Total phosphorus input to the lake would cause the four stations to increase by about .01 to .08 mg/L (table H-8-19). These changes are likewise within the ranges of variation expected in about one-half of the years at the stations. There appears to be little increased eutrophication potential relative to these increased phosphorus levels, which compare to spring normal ambient levels of about .05 to .07 mg/L. It is estimated that a nearshore location might experience a rise during April or May of about .15 mg/L if the diversion water were at a normal concentration of .27 mg/L. During the year, about 2,000 tons of phosphorus would be diverted. This, along with the increased nitrogen supply, might be sufficient to trigger occasional abundances of algae in late summer or fall along the south shore. Otherwise, it is believed that the lake would assimilate the imported nutrients without significant adverse effects, or that increased productivity would represent overall ecosystem improvement in areas several miles beyond the shoreline.

H.8.32. It is acknowledged that when the river is carrying nitrate plus nitrite loads of about 2.0 mg/L, or phosphorus levels of about 0.4 mg/L, that nearshore eutrophication would be more evident, but widespread overloading of the lake would not occur. These levels would not be exceeded more than about 10 percent of the years in diversion waters. As indicated by table H-8-19, lake total phosphorus level increases of roughly twice those of normal conditions would be expected. The 1979

Bonnet Carre' floodwater diversion caused smaller rises at the four stations, but river water phosphorus levels were then about one-half those of the 10-percent exceedence values (see tables H-8-11 and H-8-12). The assessment of long-term cumulative effects over the project lifetime is not possible with present knowledge, but should be an eventual objective of the water quality monitoring program to be initiated before project construction. It is anticipated that the thrust of late winter and spring flow rates in excess of 10,000 cfs would be sufficient to distribute nutrient loads widely throughout the western and southern reaches of the lake and that normal wind-driven circulation would further retard their rates of deposition.

H.8.33. At the IHNC station, it was found necessary to indirectly estimate project-induced changes in nitrate plus nitrite levels. Increases of up to about 1.7 mg/L occurred at the station during the 1979 Bonnet Carre' Spillway operation period (about the same as observed in the spillway) compared to peak increases of about 0.3 mg/L at Mid-Causeway, 0.8 mg/L at Pass Manchac, and 1.5 mg/L at the 10-mile distant station (tables H-8-9 and H-8-10). It is believed that much of the change at IHNC was attributable to a rainfall of more than 3 inches in New Orleans about one week after the beginning of spillway discharges. The regression equations used to estimate background nitrate levels at IHNC were not sufficiently sensitive to account for the sharp rise in nutrients and organic loads that would accompany an intense stormwater influx from an urban area. It is also likely that some partially treated domestic sewage was included with the stormwater, since the New Orleans East treatment plant was not in operation at that time, even though the absence of a sharp rise in total phosphorus level does not seem to support that presumption. Nevertheless, since fecal coliform levels at IHNC also increased during the same period to a six-day average of 424 MPN/100 ml (more than twice the Bonnet Carre' level), it was quite apparent that other influences were active.

H.8.34. The estimated nitrate plus nitrite increases at IHNC for both sets of conditions were placed between those determined for the Pass Manchac and 10-mile distant stations. Despite the occurrence of the local storm, the length of time that high nitrogen levels persisted (about six weeks above 1.0 mg/L at IHNC) suggested a significant degree of Bonnet Carre' influence did exist. Since the calculated increases for phosphorus level change at IHNC seemed reasonable, if somewhat low for the normal project design condition, it was decided to retain those values as the most reliable predictions.

H.8.35. Water temperatures in the lake would, under normal conditions, experience some reduction, primarily during March, April, and May, of project design diversions. Throughout most of the southwest quadrant, maximum reductions below background would be from about 0.4 ^{o} to 1.6 ^{o}C, against river to lake temperature gradients of about 8 ^{o} to 10 ^{o}C. (table H-8-19). Nearshore temperature reductions might approach 4 ^{o}C. During 1979 Bonnet Carre' operations, temperatures in the lake decreased by approximately twice these amounts, when effective river to lake gradients were about 9^{o} to 11^{o}C (see tables H-8-13 and H-8-14). Under the somewhat extreme combination of a 90 percent exceedence effective river temperature and 10 percent exceedence lake temperature during April and May, effective gradients of 13^{o} to 17^{o}C would be experienced. Maximum temperature reductions at the four lake stations would be from about 0.9 ^{o} to about 2.8 ^{o}C. These maximum changes would be approached gradually over periods of up to several weeks, providing ample opportunity for acclimation or movement of most motile organisms to other areas. Normal water temperature variations on the order of 2 ^{o} to 5 ^{o}C or more within a few days are not uncommon. It should be noted here that, except for nearby receiving areas, significant average response times of one to seven weeks would prevail for temperature and other parameters studied. These time periods are generally sufficient

to reduce potential stress on biological systems to acceptable levels in large receiving areas such as Lake Pontchartrain.

H.8.36. Mississippi River water introduction at the Bonnet Carre' site in project design amounts would probably freshen nearshore areas completely, or nearly so. During the spring months, normal salinity in these areas would be approximately 2 ppt. At the 10-mile distant station in a typical diversion year, salinity would be reduced by about 1.0 ppt to 0.6 ppt (see table H-8-19). The Mid-Causeway and Pass Manchac stations would each be reduced by about 0.3 ppt, while the more brackish waters at the IHNC entrance would be lowered from 2.8 ppt to 1.2 ppt. Times for maximum salinity changes to occur would vary from about 12 to 36 days among the four stations. The more extreme condition (10 percent exceedence in the lake) would result in greater salinity reductions, averaging about 1.7 ppt at the four stations. During 1979, the Bonnet Carre' operation effected salinity lowerings of from 0.5 ppt to 2.7 ppt at the four stations (tables H-8-14 and H-8-15). As for temperatures, these gradually induced changes are not expected to unduly stress organisms in the southwestern lake area.

IMPACT DISCUSSION-BACTERIAL PATHOGENS

H.8.37. Coliform bacteria have the widest application of any microorganism to the detection of possible fecal contamination of water bodies . A fecal coliform density of about 550 MPN/100 ml would be expected in diversion water during the maximum flow period of a normal-condition project design event. The 10-percent exceedence level for diversion water is 2900 MPN/100 ml. Despite the almost-daily observations of fecal coliform density at several Lake Pontchartrain stations in April, May, and June 1979, no consistent patterns with respect to Bonnet Carre' Spillway densities were detectable. The highly erratic fluctuations of colony counts at each station suggested that

altered circulation patterns and other prevailing physical and chemical conditions had prevented the progressive transport of these and other microorganisms through open-water areas. It was roughly estimated from these data that only about two to three percent of the original density at the diversion site would be in evidence at the 10-mile station. During a typical diversion season, this would be equivalent to a maximum six-day average of about 13 MPN/100 ml. Hardly any bacterial influence was discernible at the Mid-Causeway station. Considering relative travel times, distances, open-water dilution factors, and salinity levels, it appears virtually certain that no fecal coliform organisms would survive from the diversion site to oyster harvesting areas in Lake Borgne and beyond. Table H-8-19 shows estimated normal and extreme condition predictions of fecal coliform density changes at the four lake stations. Each of the primary stations' increase was roughly estimated on the basis of its open-water distance, intervening water volume and salinity levels between the station and the diversion site, relative to the 10-mile station. The evidently rapid die-off of coliforms in this setting indicated that a more intensive analysis, such as determination and application of an empirical die-off rate to the physical and chemical conditions, was not warranted.

IMPACT DISCUSSION-PESTICIDES AND OTHER SYNTHETIC ORGANIC COMPOUNDS

H.8.38. Most pesticides and other manufactured organic compounds are rarely detected in either the Mississippi River or Lake Pontchartrain. This is not to suggest that many are not present in trace quantities. Some of the more persistent organochlorines, such as the DDT family, dieldrin and endrin are detected more often in the river than in the lake, but their levels have been decreasing with time, which is expected since they are no longer in use. The diversion of river water into the lake would probably increase lake levels of pesticides and organics. The most likely potential problem, should there be one, would be

eventual significant bioaccumulations in aquatic life. Predictions of such effects are not possible, given present knowledge.

IMPACT DISCUSSION-TRACE METALS

H.8.39. Copper was the only trace metal that was analyzed in detail at the lake stations. Lead and zinc were to be included but the high detection limits of some measurements, along with the uncertainty of whether other observations were either zero or undetectable at some positive level, led to their elimination from the statistical correlations. It was recognized that total copper levels in the Bonnet Carre' Spillway in 1979 averaged only about one-half of the concentrations at the Mississippi River at Luling Ferry Station. It was assumed that river copper levels would similarly diminish in passage through the diversion structure, sediment trap, and outflow channel to Lake Pontchartrain. This would result in only slightly higher levels of copper in diversion water than in the lake under typical conditions. Thus, only minor increases of about 0.1 to 0.2 ug/L would be expected (see table H-8-19).

H.8.40. The station located about 10 miles from the spillway increased in total copper concentration by 2.8 ug/L during the maximum six-day period in 1979 (table H-8-12). Both IHNC and Pass Manchac, however, exhibited high six-day total copper levels (14.0 and 21.2) during the second week of spillway discharges (see table H-8-16). Since New Orleans experienced more than 3 inches of rain during the period, and the Amite River peaked at 69,000 cfs on April 24 at Denham Springs, these events were surmised to have contributed largely to those early peaks. The Mid-Causeway station experienced a high copper level at about the same time as the IHNC and Pass Manchac stations. Individual peak total copper observations at the 10-mile, MC, PM and IHNC stations were 12 ug/L (April 29), 42 ug/L (April 29), 80 ug/L (April 29), and 36

ug/L (April 27), respectively. The highest spillway copper observations during the intervening period were 15 ug/L on April 19 and 29. Thus, only the 10-mile station relationship was considered a valid reflection of Bonnet Carre' Spillway influence. The estimated with-project concentration changes at the three primary stations were determined using weighting factors approximately proportional to their respective peak 6-day increases and scaled down to levels seemingly consistent with the fourth station. Table H-8-19 shows predicted increases of 1.9 to 3.1 ug/L at the four stations for the condition of 10-percent exceedence river levels of total copper, and 90-percent exceedence in the lake.

H.8.41 Record-period comparisons of copper and other heavy metals in the lake and river do not reveal large differences in water concentrations of cadmium, lead, or mercury. Since metals tend to be attracted to sediment particles, significant fractions would probably be deposited during passage from the river to the lake. A definitive analysis has not been made for project conditions. Considering the apparently small concentration gradient of copper expected during normal project operation periods, and that other metals most likely to have toxic effects would not normally have high river-to-lake concentration gradients, it is not apparent that any significant short- or long-term impacts would occur. The total influx of copper to Lake Pontchartrain under normal river conditions in a diversion season would be about 50 tons.

IMPACT DISCUSSION-SUSPENDED MATTER AND TURBIDITY

H.8.42 Suspended solids residue remaining at 105 °C was included in detailed analysis of Lake Pontchartrain stations. This parameter is more commonly measured than suspended sediment, and is often a good indicator of that parameter. A normal suspended residue concentration of 116 mg/L in diversion water would produce insignificant estimated

increases at locations 10 miles or more distant (5 mg/L at 10 miles and 0 to 2 mg/L at the three primary stations, table H-8-19. This reflects the combined condition of reduced velocities and saline water that would cause deposition of most of the material within the first few miles. Comparison of concurrent Mississippi River at Luling Ferry and Bonnet Carre' Spillway suspended residue levels in 1979 reveals that about 30 percent or more of the suspended material was deposited within the spillway. It is not unreasonable to expect that a similar fraction would be deposited between the river and lake during project discharges. The value of 116 mg/L given above represents a 30 percent reduction from normal river concentration. At a 10-percent exceedence level of about 180 mg/L, the 10-mile location is estimated to increase in suspended residue by about 16 mg/L, with not more than 5 mg/L increases at the other, more distant stations. During the 1979 flood, maximum 6-day increases of about 13 to 51 mg/L were observed among the four stations (see tables H-8-12 and H-8-17).

H.8.43. Turbidity levels in the lake would change in a similar manner. Table H-8-19 indicates that the four stations would experience slight maximum rises of from 1 to 4 JTU in the diversion water. This value is an increase of 10 percent over the 50-percent exceedence level in the river, and is reflective of the observed tendency during 1979 for spillway waters to be somewhat more turbid than the river. Turbidity rises of from 4 to 26 JTU are predicted for the four lake stations against a diversion water level of about 175 JTU during the more extreme condition project operation. Undoubtedly, much higher turbidities and suspended matter levels will prevail in nearshore areas, with an ultimate submarine delta formation. The rate of growth and areal extent of a delta would depend on diversion water velocities, lake circulation patterns and currents, and wind action. Other than the possible burial of sedentary benthic organisms, no particular immediate adverse effects of the deposited material are expected. Higher nearshore turbidities should tend to offset rates of algae production that would otherwise occur with nutrient loading from the river. Six-day maximum turbidity increases of 20 to 44 JTU were observed at the four lake stations during the 1979 flood (tables H-8-10 and H-8-18).

Section 9. CONCLUSIONS

H.9.1. In the various sections of the appendix it is shown that there are some significant differences in the quality of the Mississippi River waters compared to other water bodies in the project area. Many of those differences in quality are, of course, due to the nature of the chemical reactions that occur and the hydrodynamics of a freshwater stream as opposed to fresh-to-brackish water estuarine systems. Other differences in quality result solely from the nature and quanity of inputs that these surface waters receive from anthropogenic sources.

H.9.2. None of the water bodies addressed in this appendix can be considered to be pristine in all respects. Some of the waterbodies could be considered severely polluted in terms of some, but not all, of the water quality parameters evaluated. By far, the lowest amount of dissolved oxygen sample means were computed for the Pascagoula and Escatawpa Rivers. The highest mean dissolved oxygen was computed for the Mississippi River-Gulf Outlet and the St. Louis Bay. Moderately severe problems due to low pH values were indicated by the sample means for the Tangipahoa, Tchefuncta, Pearl, West Pascagoula, and Escatawpa Rivers. Only Lake Maurepas, the Inner Harbor Navigation Canal, Gulf Intracoastal Waterway, and Back Bay of Biloxi had total phosphorus sample means greater than one-half of the aggregate mean for the Mississippi River. The aggregate sample mean of nitrite plus nitrate for the Inner Harbor Navigation Canal is about 25 percent lower than the mean for the Mississippi River. Generally, the data indicate that the mean nitrite plus nitrate concentration in the Mississippi River is from 4 to about 26 times greater than in the other water bodies evaluated. The highest mean suspended solids conceantrations were computed for the Mississippi River and the Inner Harbor Navigation Canal. Generally, computed mean suspended solids in other water bodies evaluated were less

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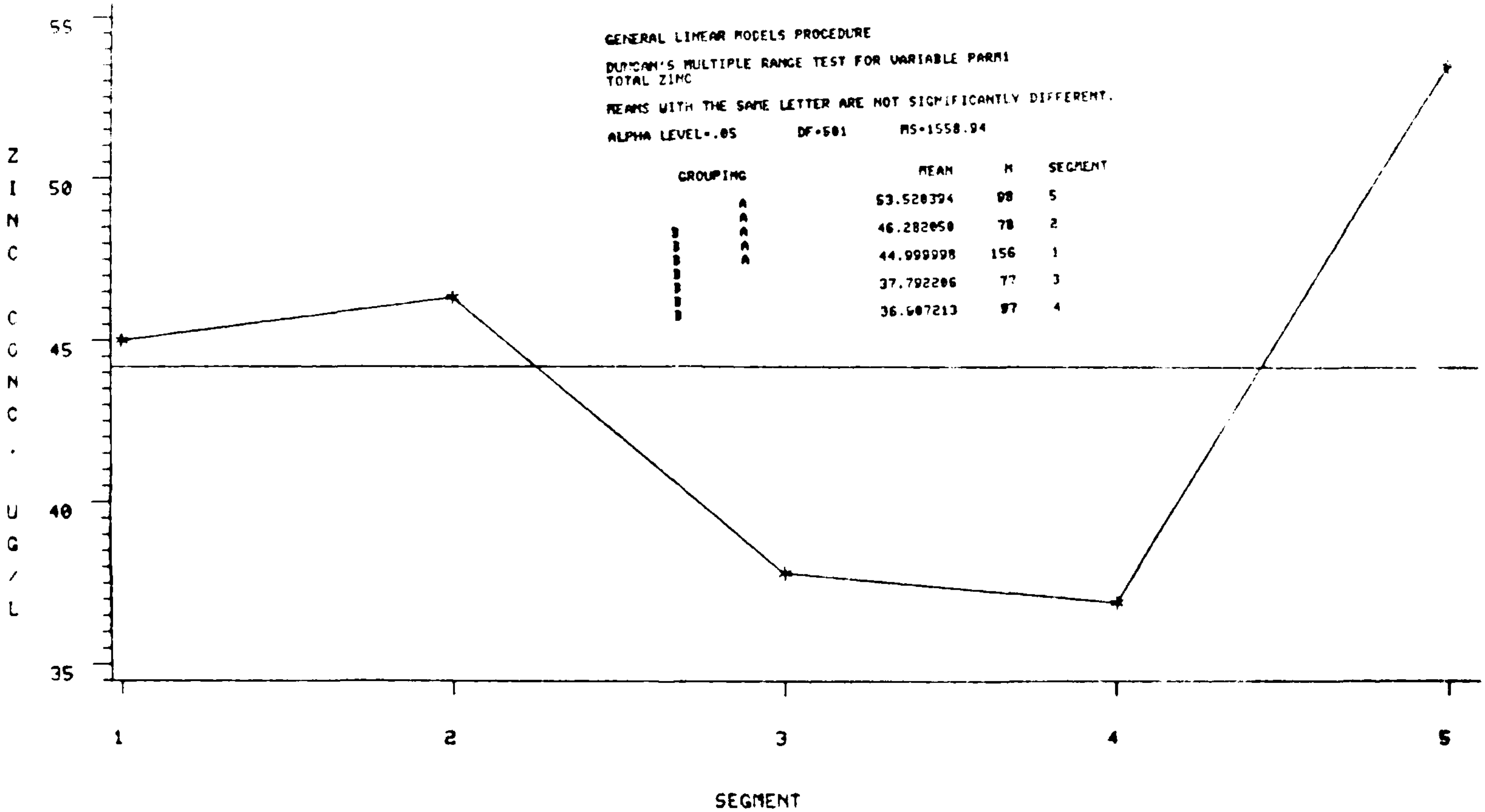

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PLATE H-3

PLATE H-3

MEAN LEAD CONCENTRATION:MISSISSIPPI RIVER

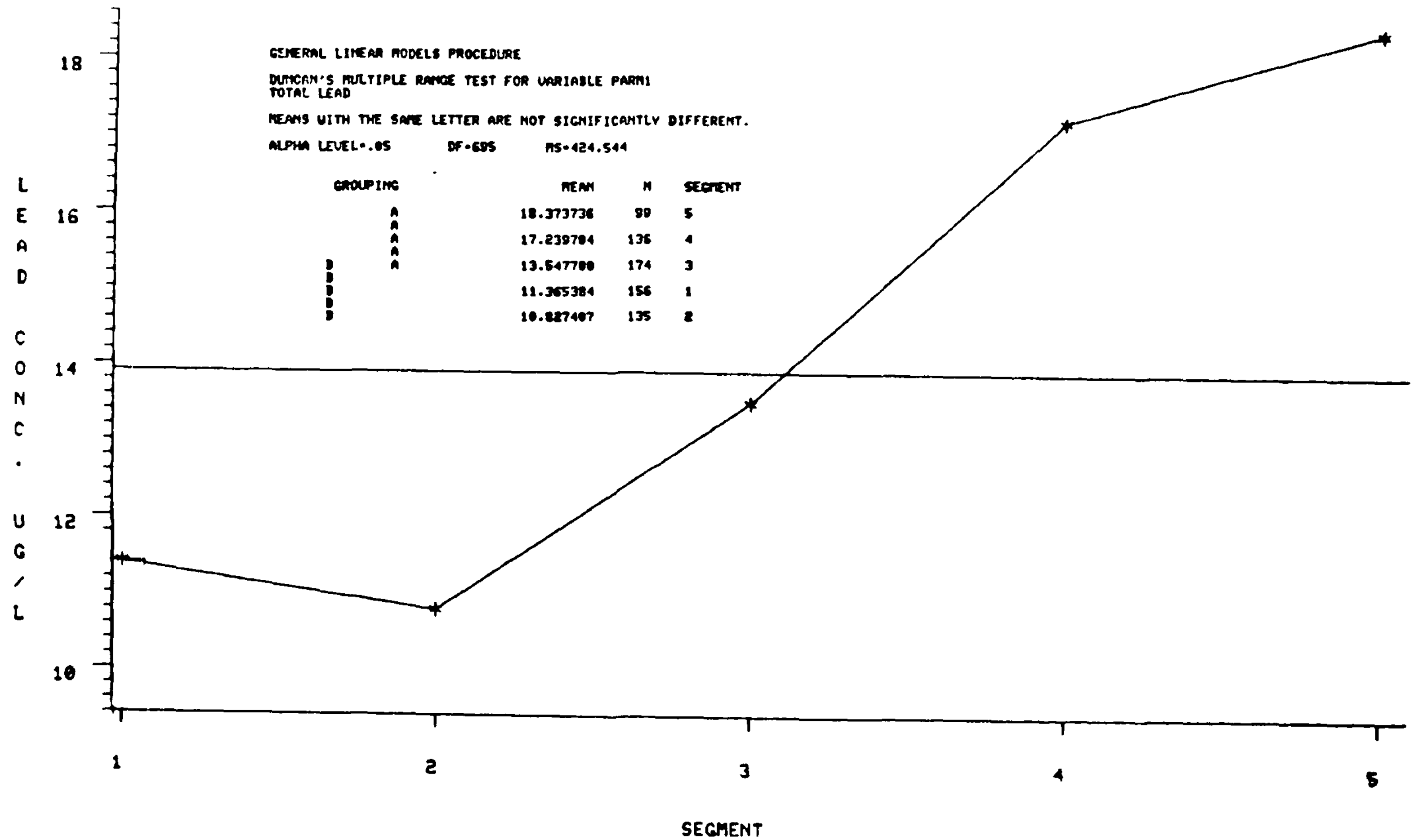

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PLATE H-2

MEAN FECAL COLIFORM DENSITY:MISSISSIPPI RIVER

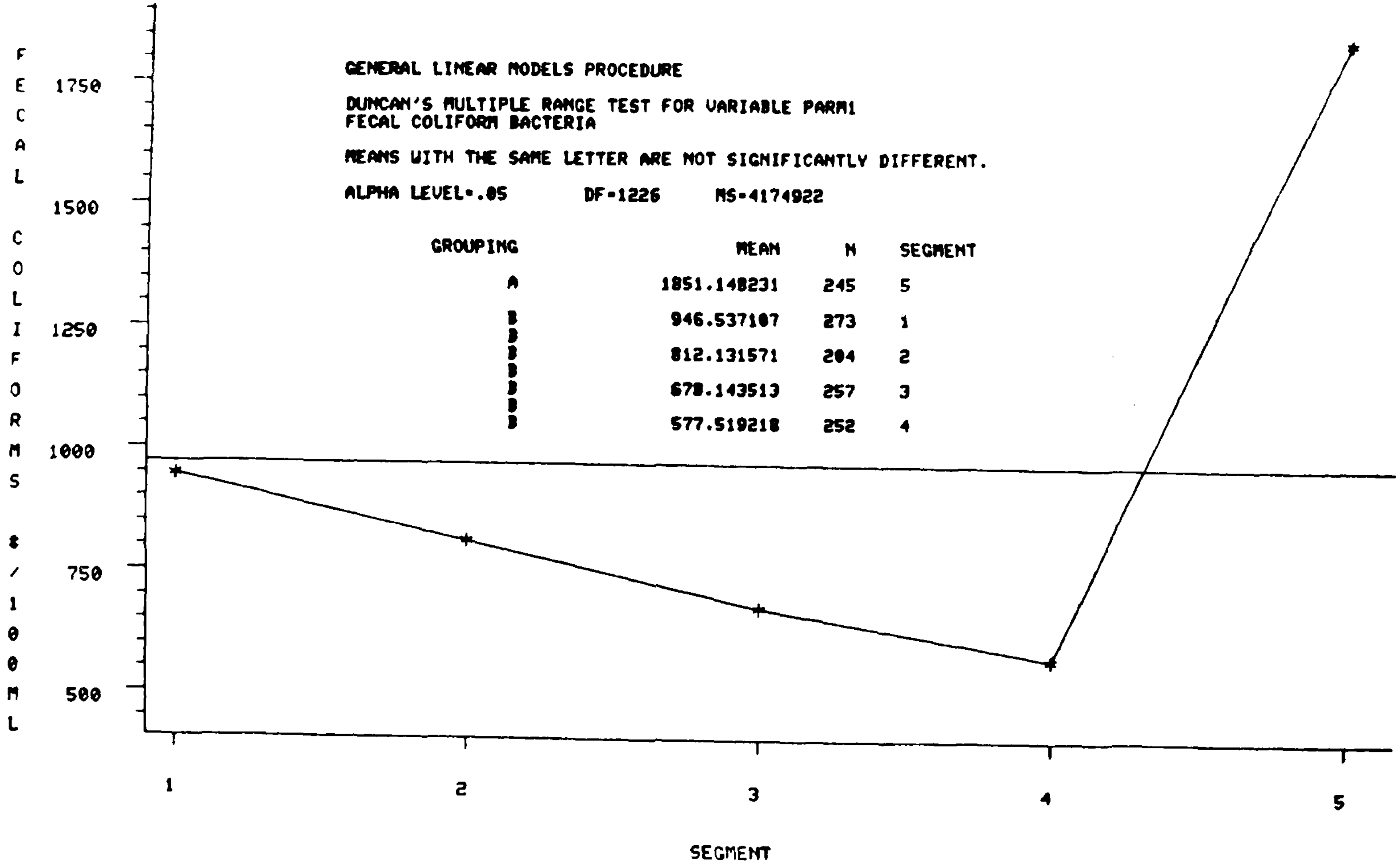

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PLATE H-1

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H.10.5. All data generated would be maintained in the EPA STORET system to provide easy access to many users. The data base thus created would be a complement to data generated from the EPA Mussell Watch Program and would be useful in indicating significant changes in the quality of Louisiana and Mississippi coastal waters.

Heptachlor

Toxaphene

Lindane

PCB

o Sediments would be analysed for the following:

Redox Potential (Eh)

pH

Total Solids

Total Volatile Solids (Residue Loss on Ignition)

Oil and Grease

Chemical Oxygen Demand

Total Kjeldahl Nitrogen

Mercury

Lead

Zinc

Chromium

Cadmium

Copper

Iron

Manganese

Nickel

Aldrin

Dieldrin

Chlordane

Endrin

Heptachlor

Lindane

DDT and metabolites

Toxaphene

PCB

- Stage 1 and 2 Sampling

Selected Organic Compounds in water and fish tissue
Total Phosphates
Orthophosphates
DO
Temperature
Specific Conductance
pH
Turbidity
COD
Fecal Coliform Bacteria
Total Hardness
Total Dissolved Solids
Total Suspended Solids
Ammonia Nitrogen
TKN
Chlorophyll a
Total Manganese
Total Chromium
Total Cadmium
Total Copper
Total Mercury
Total Nickel
Total Lead
Total Zinc
Aldrin
Dieldrin
DDT and metabolites
Endrin
Chlordane

provide a base condition by which changes in water quality resulting from fresh-water diversion could be assessed. Tracer studies would be required during Stage 1 sampling to better define existing surface water hydraulics in the receiving areas. Stage 2 sampling would consist of samples collected at the same selected locations for a period of 4 years from the initiation of freshwater diversion. This stage would provide data to assess seasonal changes and longer term trends in water and sediment quality resulting from freshwater diversion. During this 4-year fresh- water diversion impact assessment, data would be analyzed to determine any shortcomings or needed modifications in the following sampling program determinants:

- sampling station locations
- frequency of sampling
- constituents included in sample analyses

H.10.4. The sampling program could be modified at any time to improve the efficacy. Tracer studies would be required during the Stage 2 sampling to define project-induced changes in the surface water hydraulics of the receiving areas. By conclusion of the Stage 2 sampling, a decision would have to have been made as to the direction and nature of further water quality analyses (Stage 3). If it were determined that the data collected in Stage 2 sampling provided a reasonably good idea of water quality impacts, sampling beyond the 4-year period could be curtailed to a reduced number of sampling stations, parameter analyses, and reduced sampling frequency. Conversely, the results of Stage 2 sampling could indicate a need for continuing or expanding the previous sampling program. Surface water constituents to be monitored would consist of the following:

Section 10. WATER QUALITY MONITORING

H.10.1. A water quality sampling program for this study must be a necessary component of the freshwater diversion project. Such a program is essential because of the potential for polluting substances in the Mississippi River, the freshwater source. The presence of high fecal coliform bacteria densities, heavy metals, nutrients, and agricultural and industtial chemicals in the Mississippi River is a concern. A sampling program would provide synoptic data for measuring the presence of constituents at locations throughout the freshwater receiving areas in both surface waters and sediments. The program envisioned would measure selected water quality parameters before freshwater diversion is initiated to supplement historical base condition data, and after freshwater diversion is initiated to assess changes in constituent concentrations. A very preliminary outline of such a monitoring program follows. A detailed monitoring program would be designed using the preconstruction planning phase of the project. The program would be closely coordinated with other monitoring efforts developed to measure biological and hydrologic parameters. Appendix K discusses these programs.

H.10.2. Sample collection locations would include the diversion structure location at the Mississippi River and perhaps 21 sampling locations in the Lake Pontchartrain Basin and west Mississippi Sound. Some sampling stations from currently active state, USGS, and US Army Corps of Engineers sampling programs could possibly be used. Tentative sampling site locations are shown in Appendix K. Final sampling site selection would be developed as part of the detailed design of the water quality monitoring program.

H.10.3. The proposed water quality sampling program would be conducted in three distinct stages. Stage 1 sampling would consist of sufficient sampling to define seasonal and climatic variations at strategic locations in the 3 years prior to initiating freshwater diversion. These data combined with presently available historical data would

to some degree of deterioration in quality. Increased salinity and greater nutrient inputs are two important manifestations of these activities. By partially controlling salinity in the receiving bodies, the diversion project will help to overcome some of these effects. By further increasing the nutrient supply, occasional adverse impacts in nearby areas are expected, but not enough is known about the complex processes that govern nutrient assimilation and utilization throughout the estuarine area to make definite long-range impact predictions. The existing trophic state of Lake Pontchartrain open water areas suggest, however, that many decades of diversion could occur without significantly altering that conditon.

changes expected to be other than gradual and moderate in comparison to normal variability. Some nuisance algae production may be occasioned by diversion in nearshore areas but this may be largely offset by increased turbidity, and by improved rearation rates and increased circulation. There is no reason to suspect that sediments or other constituents of diversion water would become concentrated in any particular area of receiving waters.

H.9.12. Perhaps the most important question for which even approximate answers do not exist is that of potential bioaccumulation of harmful pollutants. The proposed water quality and biological monitoring programs should yield the types of data that, together with expert analyses, can begin to provide some valuable insights into the question. In time, certain trends and patterns should become detectable. This knowledge could be used to minimize whatever impacts were perceived, either by halting or limiting diversions in certain years and months.

H.9.13. The fact that many of the more persistent pesticides have been detected less frequently in recent years in the river, and that concentrations of many other known toxic substances have not been increasing or even appear to be decreasing despite increased industrialization is encouraging. There has not been enough water quality data collected over the years to establish irrefutable trends, but the proposed monitoring program should also help to improve on that.

H.9.14. Recognized water quality changes and other changes in the Lake Pontchartrain and Lake Borgne Basin in recent decades have been largely the result of man's activities, most notably the building of Mississippi River flood protection levees. Other major factors, such as canal dredging, tributary channel improvements, land clearing, and urbanization with its attendant waste production, have each contributed

considerable disparity between flow rates. Yet, examination of the results relative to each station's distance from the site, in the light of known or perceived transport patterns and boundary influences, lends a measure of confidence that the predictions are at least reasonable.

H.9.9. In view of the ranges of variation of water quality parameter levels commonly observed at lake station locations over periods of weeks and months, it should be recognized that the discharge of up to 30,000 cfs of Mississippi River water will not impose particularly unusual effects upon the lake in general terms. The design flow rates, being relatively high in March through June, are also characteristic of the seasonal pattern of runoff in river basins of the area.

H.9.10. Although comprehensive studies of Lake Pontchartrain and Lake Borgne responses to floodwater diversions, including detailed analyses of physical, chemical, and biological effects have not been made, there has been no particular evidence of severe, prolonged, or irreversible impacts to these water bodies. Although some adverse fishery effects have been recognized during and immediately after diversion years, there have been environmental benefits credited to the floodwater discharges, including increased ecosystem productivity and improved fisheries in post-diversion years.

H.9.11. It is generally concluded that periodic diversions of up to about 30,000 cfs on an average of once every two or three years will not significantly alter water quality beyond the first few miles from the diversion site, other than for salinity and temperature. Mississippi River water is often much cooler than either Lake Pontchartrain or its tributaries, particularly during March and April. Nevertheless, most of the resident species in areas nearest the diversion site are well-adapted to the salinity and temperature changes predicted to occur.

H.9.12. Only within the first few miles of diversion are quantitative

affected by Bonnet Carre'Spillway discharges (April, May, June, and July). These predicted values were compared to average observed values, collected more or less daily in consecutive five-to-eight day intervals throughout the discharge period, to define water quality level differences attributable to floodwater diversion.

H.9.5. Spillway discharge and water quality measurements during the same period were then mathematically related to each lake station's estimated ambient water quality levels and differences to derive predictive equations (one for each of eight parameters at each station). The equations defined parameter gradient ratio (parameter level change at a station compared to difference between the diversion water and ambient level) in terms of gradient flux (discharge rate times the parameter gradient between diversion water and lake station).

H.9.6. Two sets of hypothetical river and lake water quality conditions were considered: a normal, or 50-percent exceedence condition in each water body during diversion months, and an extreme, 10-percent exceedence river vs 90-percent exceedence lake for each parameter, except temperature and salinity, where the reverse relationship was used to represent the more critical case.

H.9.7. Application of the equations to these conditions at each of three primary stations at Mid-Causeway, Mouth of Pass Manchac, and IHNC entrance, and a fourth station about 10 miles to the north-northeast of the diversion site, yielded parameter level changes over time. The maximum predicted differences are summarized in table H-8-19.

H.9.8. These predicted changes should not be regarded as more than they are - preliminary estimates based on a few years of data and the presumption that the receiving waters would respond to the diversion flows in the same manner as during a flood event, despite the

than one-third of the Mississippi River mean value. Mean bacterial densities varied widely for the study area. The highest mean values were indicated for various locations along the south shore of Lake Pontchartrain and in the Inner Harbor Navigation Canal. Only those areas had mean bacterial densities higher than the Mississippi River. Available data indicate that some trace metals; particularly cadmium, copper, and perhaps lead, are found in the study area of concentrations that might be considered excessive when compared to EPA criteria. Very limited data suggest that many volatile and semi-volatile organic compounds are present, at very low concentrations, in waters of the study area. Almost without exception, some component of overall water quality in each of the water bodies evaluated could be considered cause for concern. Although there appear to be specific problem areas, generally the waters of the project area adequately support the multiple uses for which they have been designated.

H.9.3. Impacts of freshwater diversion to Lake Pontchartrain were quantitatively predicted in terms of key water quality parameter level changes at four stations located 10 to 22 miles from the proposed outfall. Two other stations, 2 and 29 miles distant, were examined in less detail to determine relative effects along the immediate nearshore and the north shore. An additional pair of south shore stations located 15 and 27 miles from the outfall were analyzed for salinity and temperature effects.

H.9.4. Lake Pontchartrain water quality data were correlated statistically with observed runoff and rainfall data for the 1974-1981 period. The derived relationships were then adjusted to reflect long-term runoff and rainfall data back to 1939. Application of the resultant equations to conditions at the time of the 1979 Mississippi River flood yielded estimated (without-discharge) ambient parameter levels at three lake stations for months known or suspected to be

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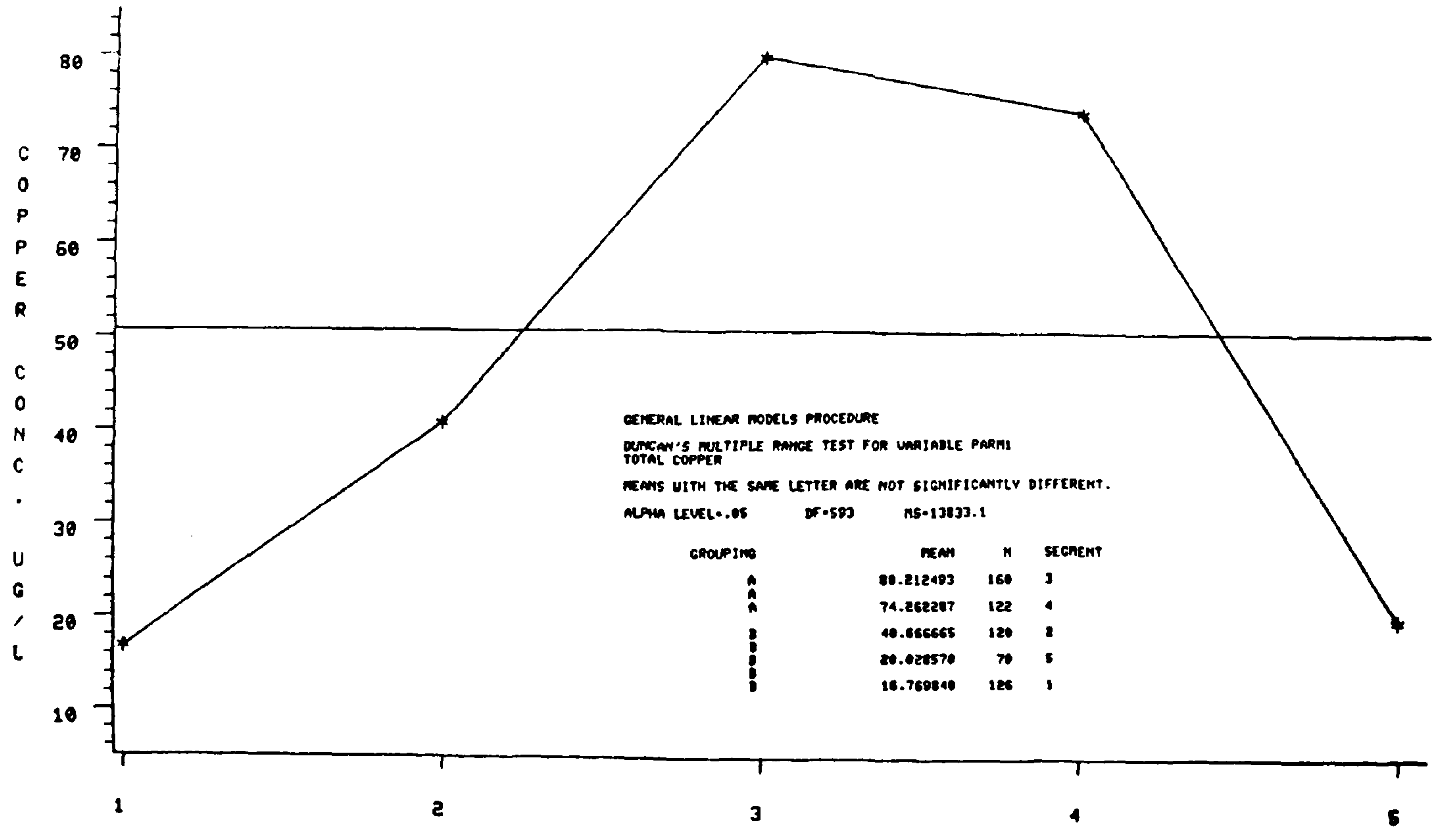

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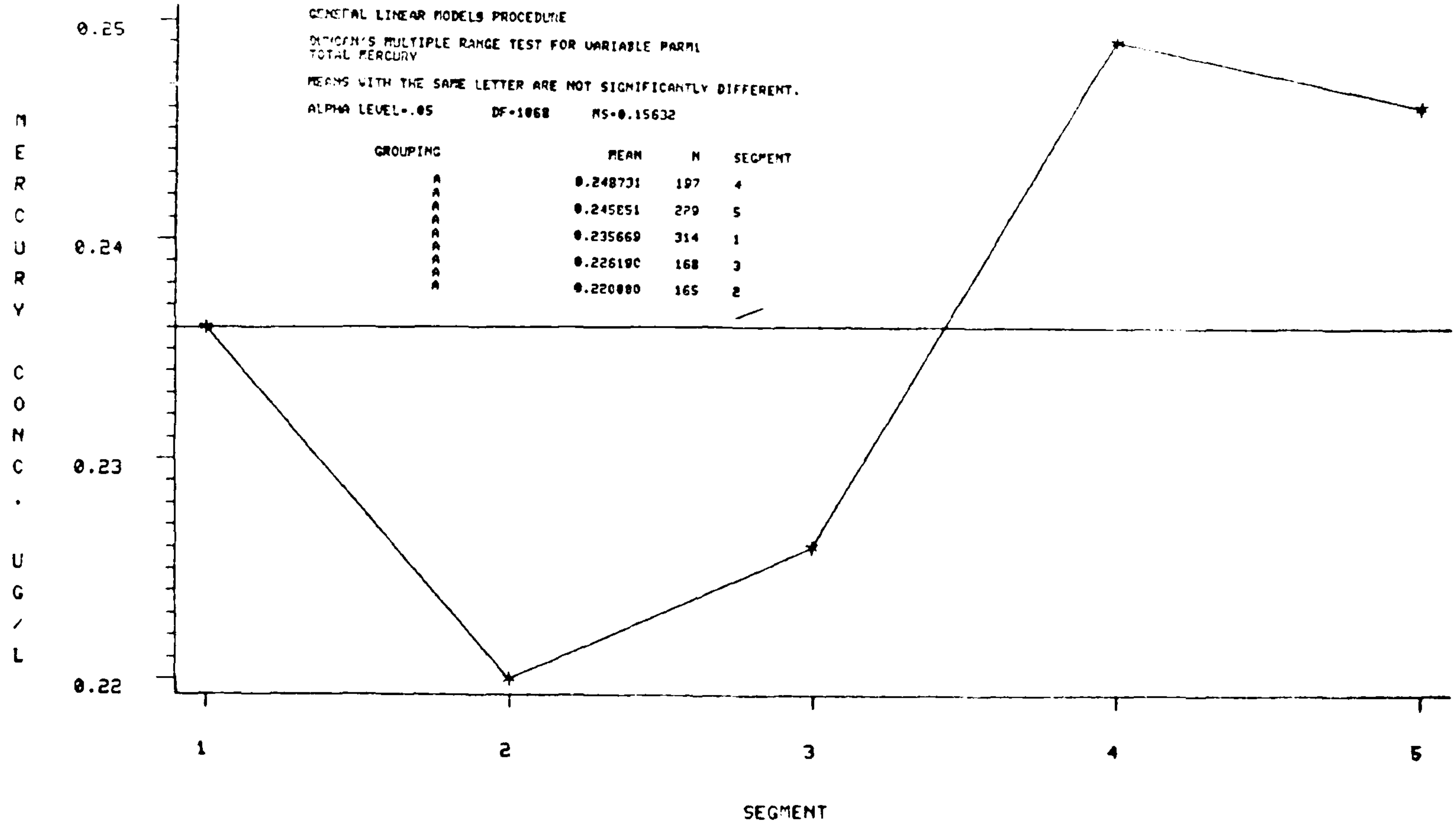
PLATE H-4

MEAN MERCURY CONCENTRATION:MISSISSIPPI RIVER



SEGMENT 1: RM 208-RM 168 SEGMENT 2: RM 168-RM 148
SEGMENT 3: RM 148-RM 121 SEGMENT 4: RM 121-RM 104
SEGMENT 5: RM 104-RM 80

PLATE H-5

PLATE H-5

MEAN CADMIUM CONCENTRATION:MISSISSIPPI RIVER

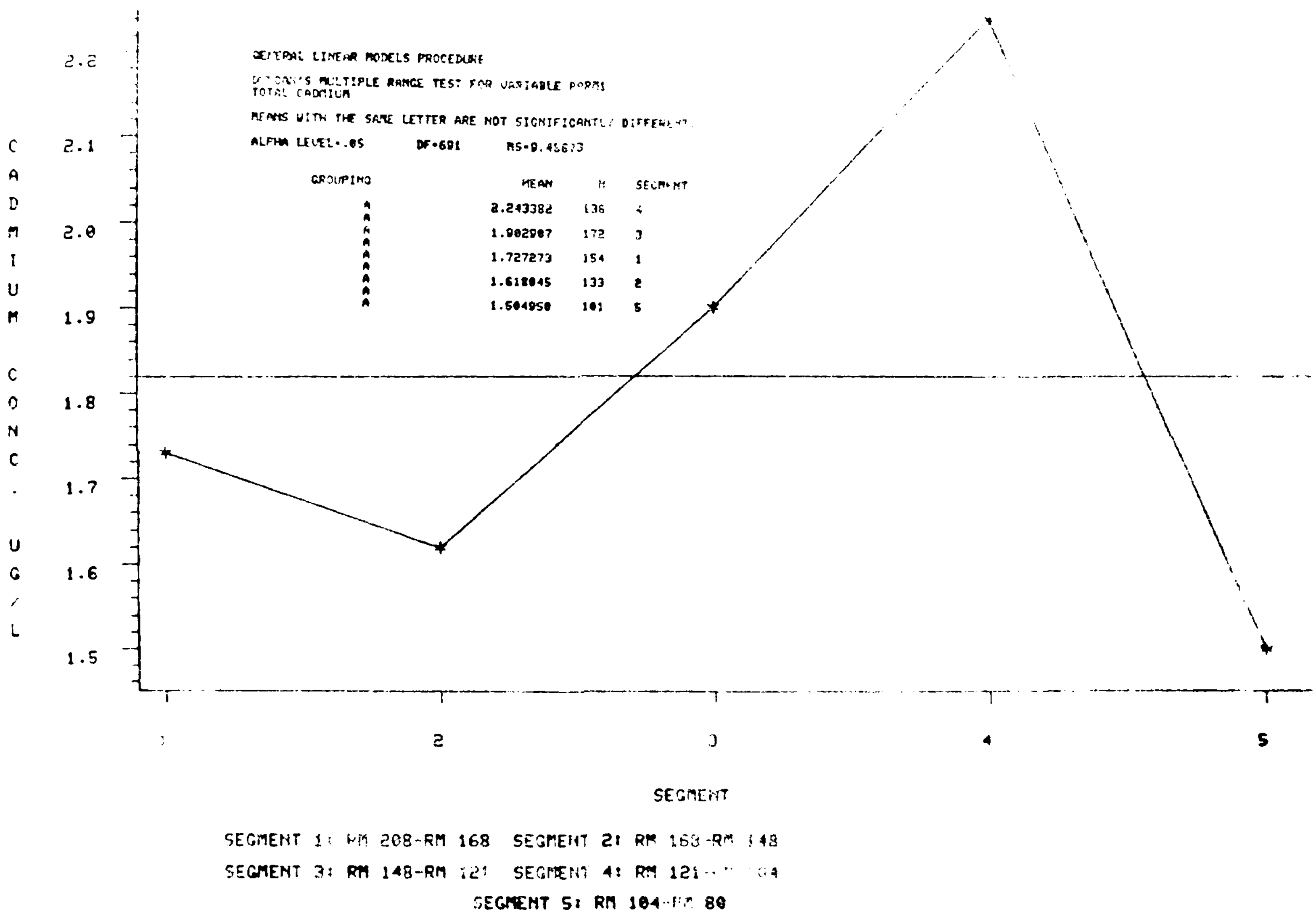
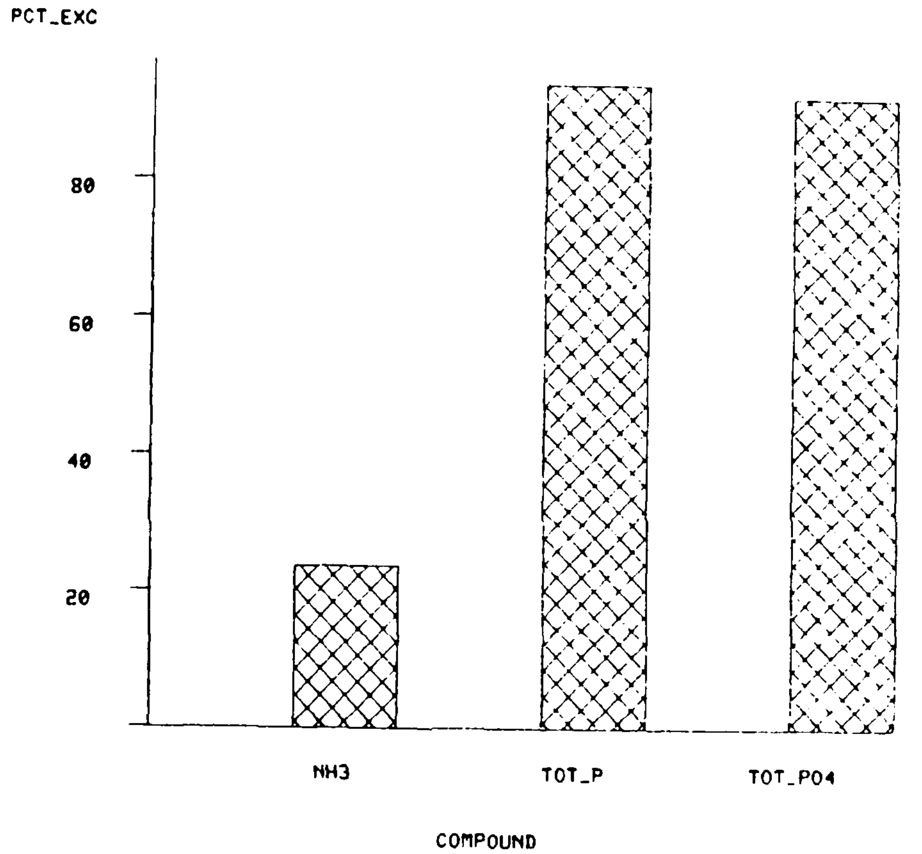


PLATE H-6

HISTOGRAM OF FRESHWATER CRITERIA EXCEEDANCES



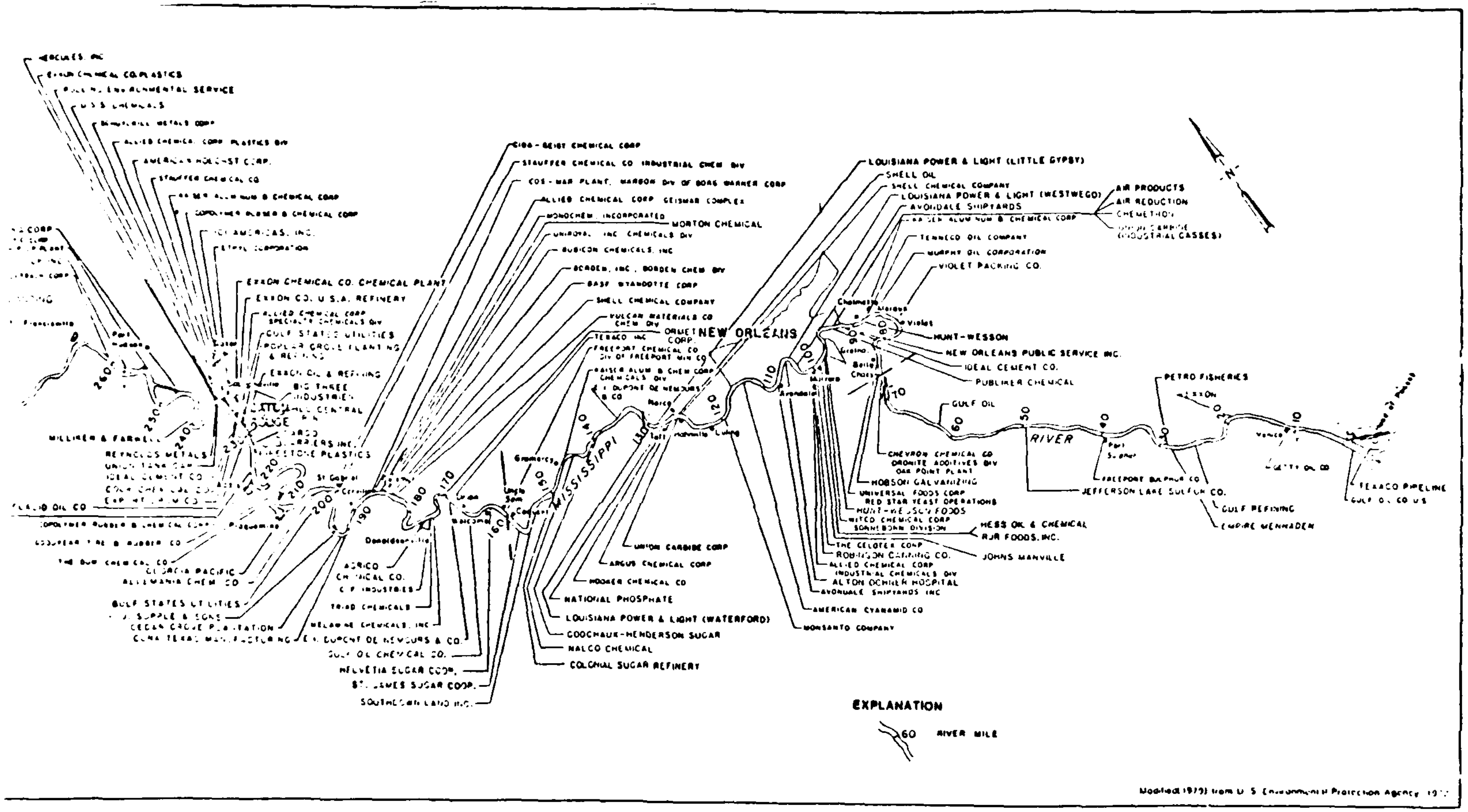
SUMMARY OF FRESHWATER CRITERIA EXCEEDANCES
MISSISSIPPI RIVER-MILE 155 TO MILE 75 AHP

OBS	COMPOUND	MEAN	CRITERIA	NUM_EXC	TOT_OBS	PCT_EXC
1	TOT_PO4	179.2	50	199	216	92.13
2	TOT_P	305.0	100	568	605	93.89
3	NH3	11.6	20	80	337	23.74

Concentrations are in ug/l.

MISSISSIPPI RIVER–MILE 155 *TO MILE* 75 *AHP*

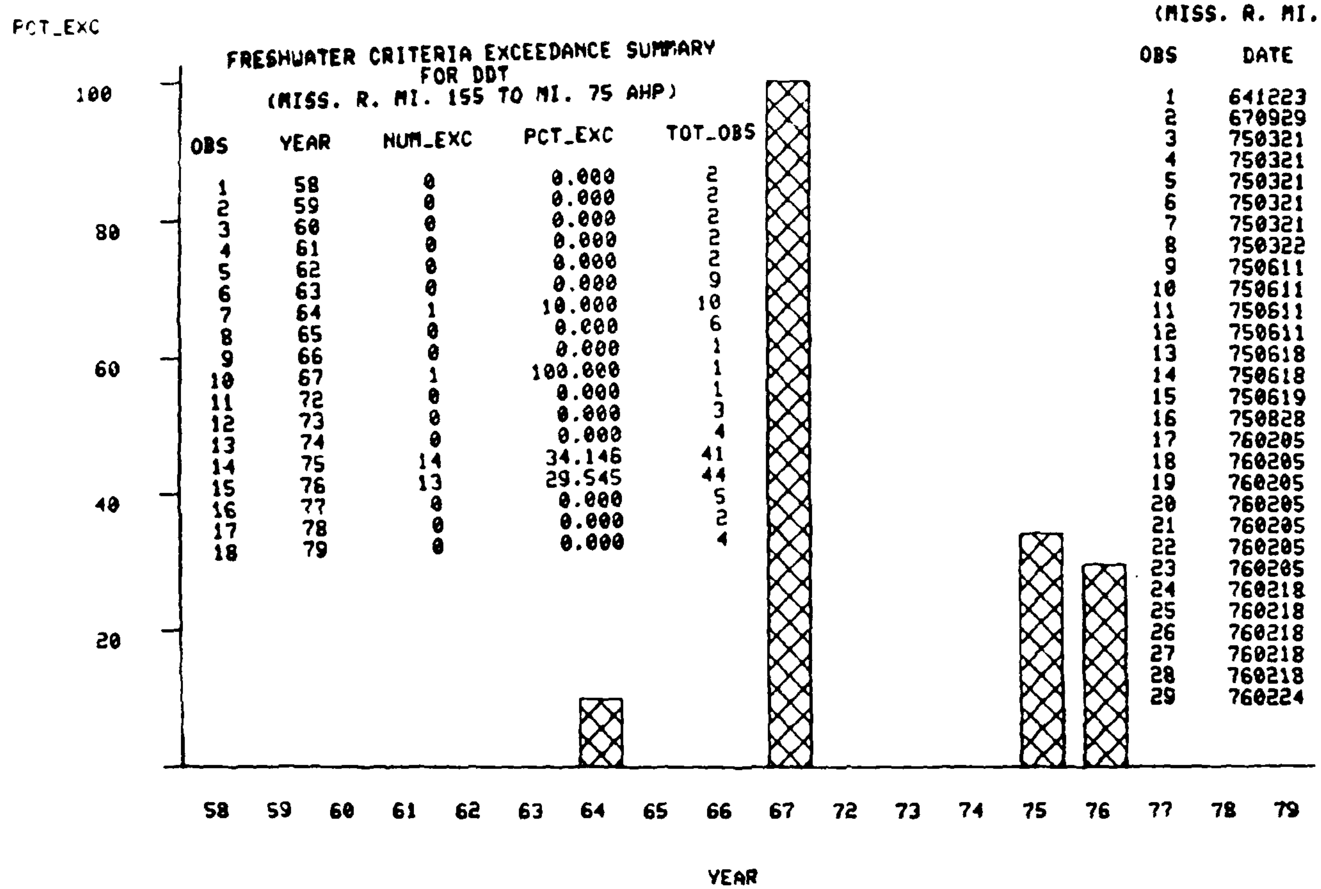
PLATE H-



INDUSTRIAL AND ELECTRICAL PLANTS ALONG THE LOWER MISSISSIPPI RIVER, ST. FRANCISVILLE TO HEAD OF PASSES, LOUISIANA

PLATE H-8

HISTOGRAM OF PERCENT FRESHWATER CRITERIA EXCEEDANCES
FOR DDT



FRESHWATER CRITERIA EXCEEDANCE SUMMARY
FOR DDT
(MISS. R. MI. 155 TO MI. 75 AHP)

OBS	YEAR	NUM_EXC	PCT_EXC	TOT_OBS
1	58	0	0.000	2
2	59	0	0.000	2
3	60	0	0.000	2
4	61	0	0.000	2
5	62	0	0.000	2
6	63	0	0.000	9
7	64	1	10.000	10
8	65	0	0.000	6
9	66	0	0.000	1
10	67	1	100.000	1
11	72	0	0.000	1
12	73	0	0.000	3
13	74	0	0.000	4
14	75	14	34.146	41
15	76	13	29.545	44
16	77	0	0.000	5
17	78	0	0.000	2
18	79	0	0.000	4

FRESHWATER CRITERIA EXCEEDANCE SUMMARY
FOR DDT
(MISS. R. MI. 155 TO MI. 75 AHP)

OBS	DATE	CRITERIA	DDT
1	641223	0.001	0.019
2	670929	0.001	0.008
3	750321	0.001	0.010
4	750321	0.001	0.010
5	750321	0.001	0.010
6	750321	0.001	0.010
7	750321	0.001	0.010
8	750322	0.001	0.010
9	750611	0.001	0.010
10	750611	0.001	0.010
11	750611	0.001	0.010
12	750611	0.001	0.010
13	750618	0.001	0.010
14	750618	0.001	0.010
15	750619	0.001	0.010
16	750828	0.001	0.010
17	760205	0.001	0.020
18	760205	0.001	0.020
19	760205	0.001	0.010
20	760205	0.001	0.020
21	760205	0.001	0.010
22	760205	0.001	0.010
23	760205	0.001	0.010
24	760218	0.001	0.010
25	760218	0.001	0.010
26	760218	0.001	0.010
27	760218	0.001	0.010
28	760218	0.001	0.010
29	760224	0.001	0.010

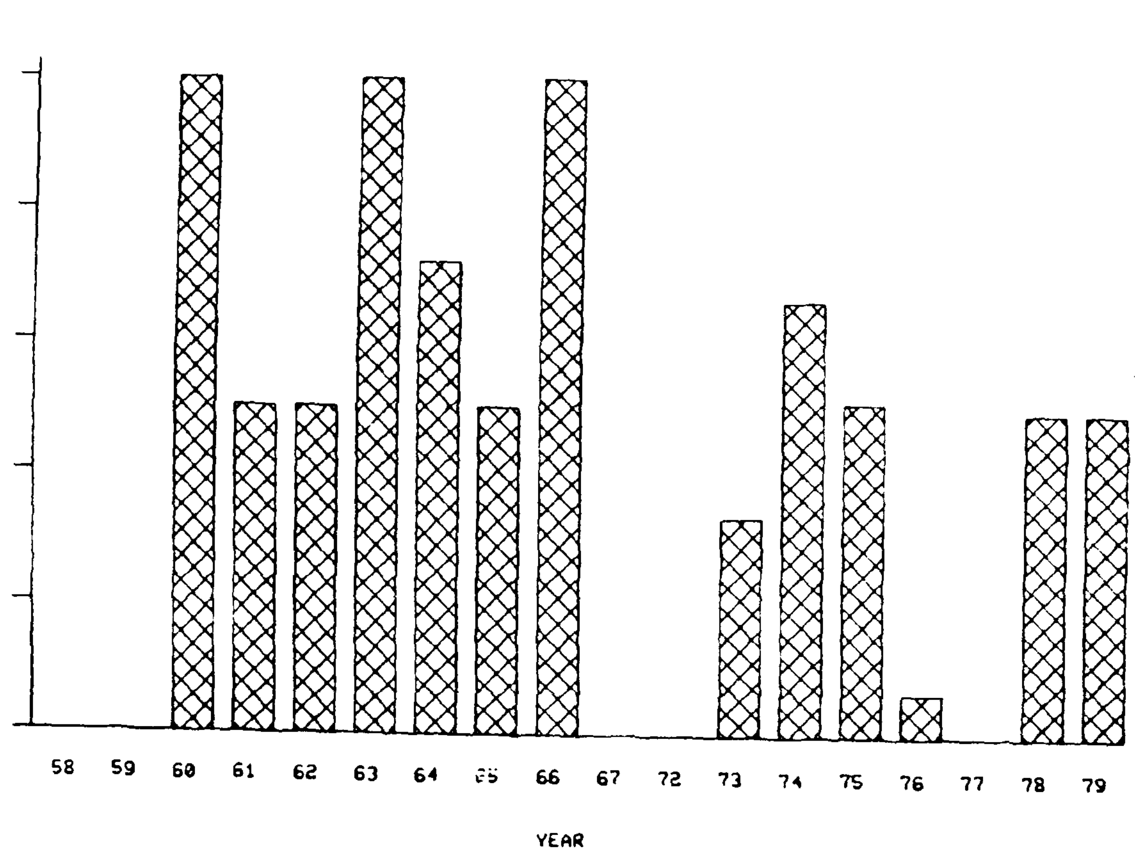
24-*HOUR AVERAGE CRITERIA*=0.001*UG/L*
(*MISS. R. MI.* 155 *TO MI.* 75 *AHP*)

PLATE H-9

HISTOGRAM OF PERCENT FRESHWATER CRITERIA EXCEEDANCES
FOR DIELDRIN

FRESHWATER CRITERIA EXCEEDANCE SUMMARY
FOR DIELDRIN
(MISS. R. MI. 155 TO MI. 75 AHP)

OBS	YEAR	NUM_EXC	PCT_EXC	TOT_OBS
1	58	0	0.000	2
2	59	0	0.000	2
3	60	2	100.000	2
4	61	1	50.000	2
5	62	1	50.000	2
6	63	9	100.000	9
7	64	18	72.000	25
8	65	3	50.000	6
9	66	1	100.000	1
10	67	0	0.000	1
11	72	0	0.000	1
12	73	1	33.333	3
13	74	2	66.667	3
14	75	21	51.220	41
15	76	3	6.818	44
16	77	0	0.000	5
17	78	1	50.000	2
18	79	2	50.000	4



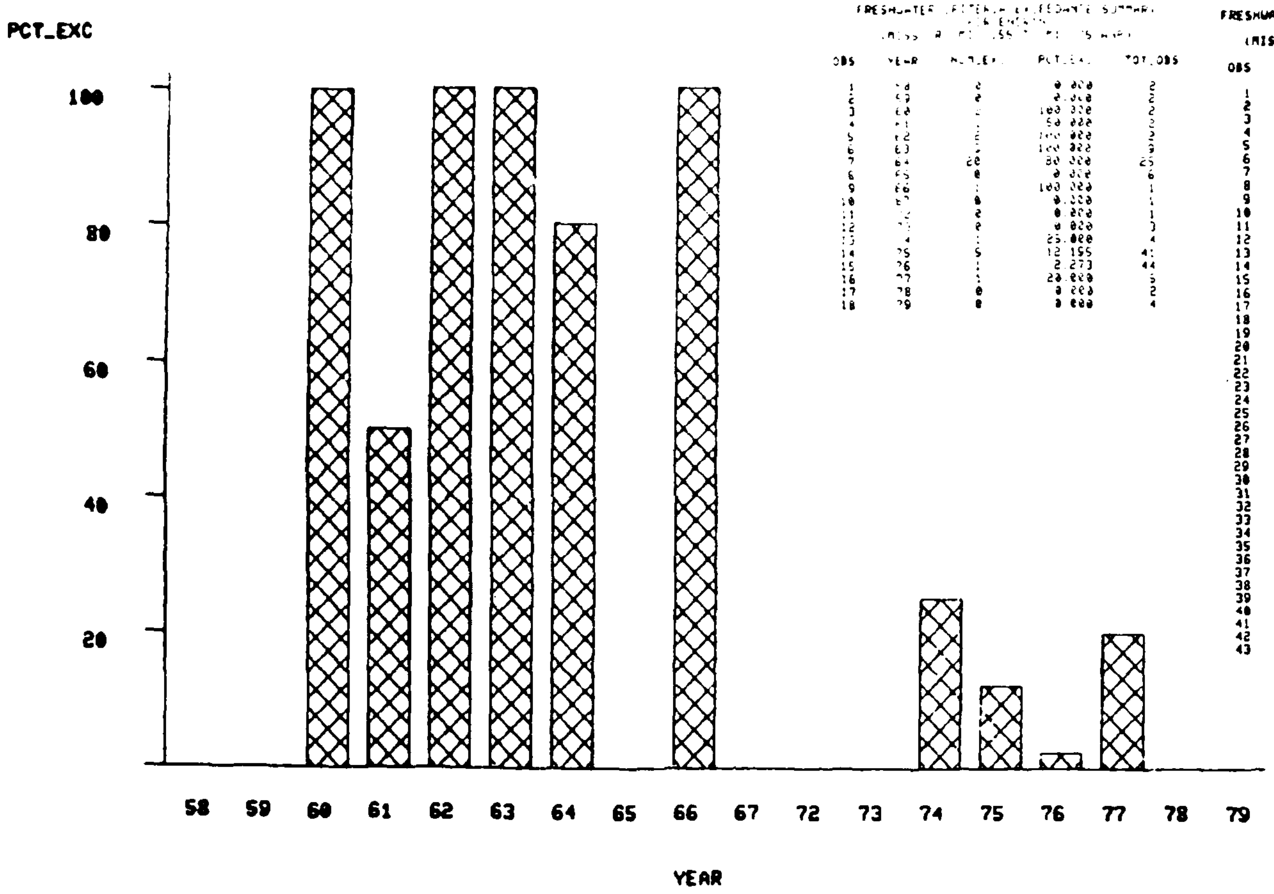
FRESHWATER CRITERIA EXCEEDANCE SUMMARY
FOR DIELDRIN
(MISS. R. MI. 155 TO MI. 75 AHP)

OBS	DATE	CRITERIA	DIELDRIN
1	600728	0.0019	0.002
2	[illegible]	0.0019	0.014
3	[illegible]	0.0019	0.006
4	[illegible]	0.0019	0.015
5	[illegible]	0.0019	[illegible]
6	[illegible]	0.0019	0.013
7	[illegible]	0.0019	[illegible]
8	630913	0.0019	0.024
9	631022	0.0019	[illegible]
10	631010	0.0019	[illegible]
11	631023	0.0019	[illegible]
12	631119	0.0019	[illegible]
13	631205	0.0019	[illegible]
14	640110	0.0019	[illegible]
15	[illegible]	0.0019	[illegible]
16	640207	0.0019	0.015
17	640215	0.0019	[illegible]
18	640305	0.0019	0.005
19	640403	0.0019	0.002
20	640422	0.0019	0.002
21	640512	0.0019	0.002
22	640519	0.0019	0.003
23	640527	0.0019	[illegible]
24	640615	0.0019	0.003
25	640623	0.0019	0.011
26	640701	0.0019	0.003
27	640708	0.0019	0.004
28	640716	0.0019	0.007
29	640909	0.0019	0.005
30	641116	0.0019	[illegible]
31	[illegible]	0.0019	0.007
32	650322	0.0019	0.002
33	650414	0.0019	0.003
34	[illegible]	0.0019	0.005
35	660913	0.0019	0.005
36	730309	0.0019	0.010
37	740815	0.0019	0.010
38	[illegible]	0.0019	0.010
39	[illegible]	0.0019	0.010
40	750611	0.0019	0.010
41	750611	0.0019	0.010
42	750611	0.0019	0.010
43	750611	0.0019	0.010
44	750611	0.0019	0.010
45	750611	0.0019	0.010
46	[illegible]	0.0019	0.010
47	750618	0.0019	0.010
48	750618	0.0019	0.010
49	750618	0.0019	0.010
50	[illegible]	0.0019	0.010
51	[illegible]	0.0019	0.010
52	[illegible]	0.0019	0.010
53	750619	0.0019	0.010
54	750710	0.0019	0.010
55	[illegible]	0.0019	0.010
56	[illegible]	0.0019	0.010
57	751106	0.0019	0.010
58	[illegible]	0.0019	0.010
59	751125	0.0019	0.010
60	760401	0.0019	0.010
61	760406	0.0019	0.010
62	760714	0.0019	0.010
63	781024	0.0019	0.002
64	790713	0.0019	0.002
65	790713	0.0019	0.006

24-HOUR AVERAGE CRITERIA*=0.0019*UG/L
(*MISS. R. MI.* 155 *TO MI.* 75 *AHP*)

PLATE H-10

HISTOGRAM OF PERCENT FRESHWATER CRITERIA EXCEEDANCES
FOR ENDRIN



FRESHWATER CRITERIA EXCEEDANCE SUMMARY
FOR ENDRIN
(MISS. R. MI. 155 TO MI. 75 AHP)

OBS	YEAR	NUM_EXC	PCT_EXC	TOT_OBS
1	58	0	0.000	2
2	59	0	0.000	2
3	60	2	100.000	2
4	61	1	50.000	2
5	62	2	100.000	2
6	63	3	100.000	3
7	64	20	80.000	25
8	65	0	0.000	6
9	66	1	100.000	1
10	67	0	0.000	1
11	72	0	0.000	1
12	73	0	0.000	3
13	74	1	25.000	4
14	75	5	12.195	41
15	76	1	2.273	44
16	77	1	20.000	5
17	78	0	0.000	2
18	79	0	0.000	4

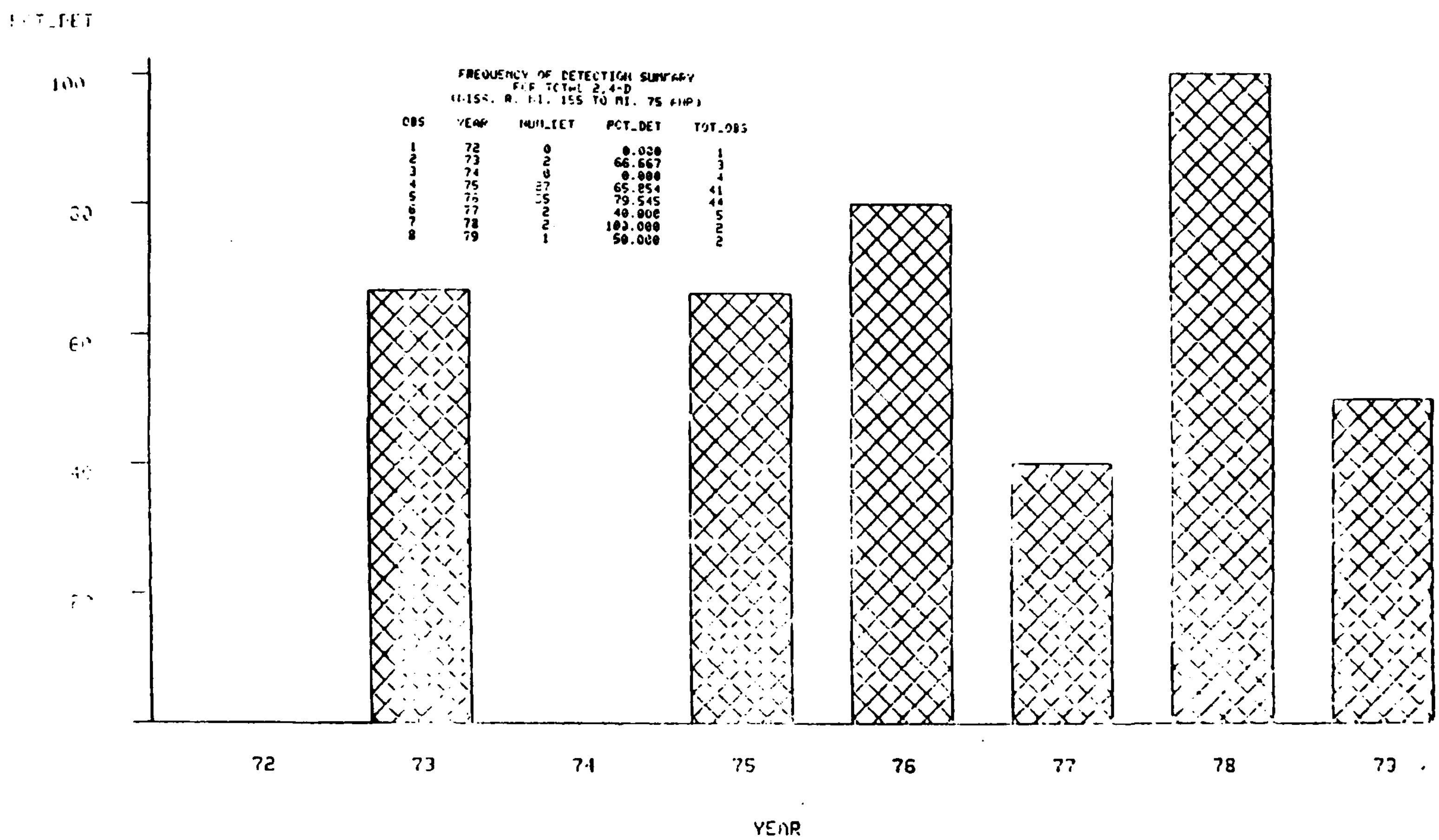
FRESHWATER CRITERIA EXCEEDANCE SUMMARY
FOR ENDRIN
(MISS. R. MI. 155 TO MI. 75 AHP)

OBS	DATE	CRITERIA	ENDRIN
1	600720	0.0023	0.004
2	601017	0.0023	0.064
3	610905	0.0023	0.029
4	620717	0.0023	0.009
5	620820	0.0023	0.160
6	630711	0.0023	0.009
7	630825	0.0023	0.074
8	630906	0.0023	0.082
9	630913	0.0023	0.063
10	631002	0.0023	0.060
11	631010	0.0023	0.134
12	631023	0.0023	0.054
13	631119	0.0023	0.019
14	631209	0.0023	0.140
15	640110	0.0023	0.009
16	640124	0.0023	0.051
17	640207	0.0023	0.102
18	640219	0.0023	0.066
19	640305	0.0023	0.041
20	640403	0.0023	0.005
21	640428	0.0023	0.004
22	640416	0.0023	0.003
23	640422	0.0023	0.004
24	640512	0.0023	0.003
25	640519	0.0023	0.007
26	640527	0.0023	0.005
27	640615	0.0023	0.009
28	640623	0.0023	0.033
29	640701	0.0023	0.025
30	640708	0.0023	0.066
31	640716	0.0023	0.015
32	640909	0.0023	0.020
33	641116	0.0023	0.008
34	641223	0.0023	0.004
35	660913	0.0023	0.011
36	740815	0.0023	0.010
37	750828	0.0023	0.010
38	751029	0.0023	0.020
39	751106	0.0023	0.010
40	751120	0.0023	0.010
41	751125	0.0023	0.010
42	761016	0.0023	0.010
43	770707	0.0023	0.010

24-HOUR AVERAGE CRITERIA=0.0023UG/L
(MISS. R. MI. 155 TO MI. 75 AHP)

PLATE H-11

FREQUENCY OF DETECTION HISTOGRAM FOR TOTAL 2,4-D



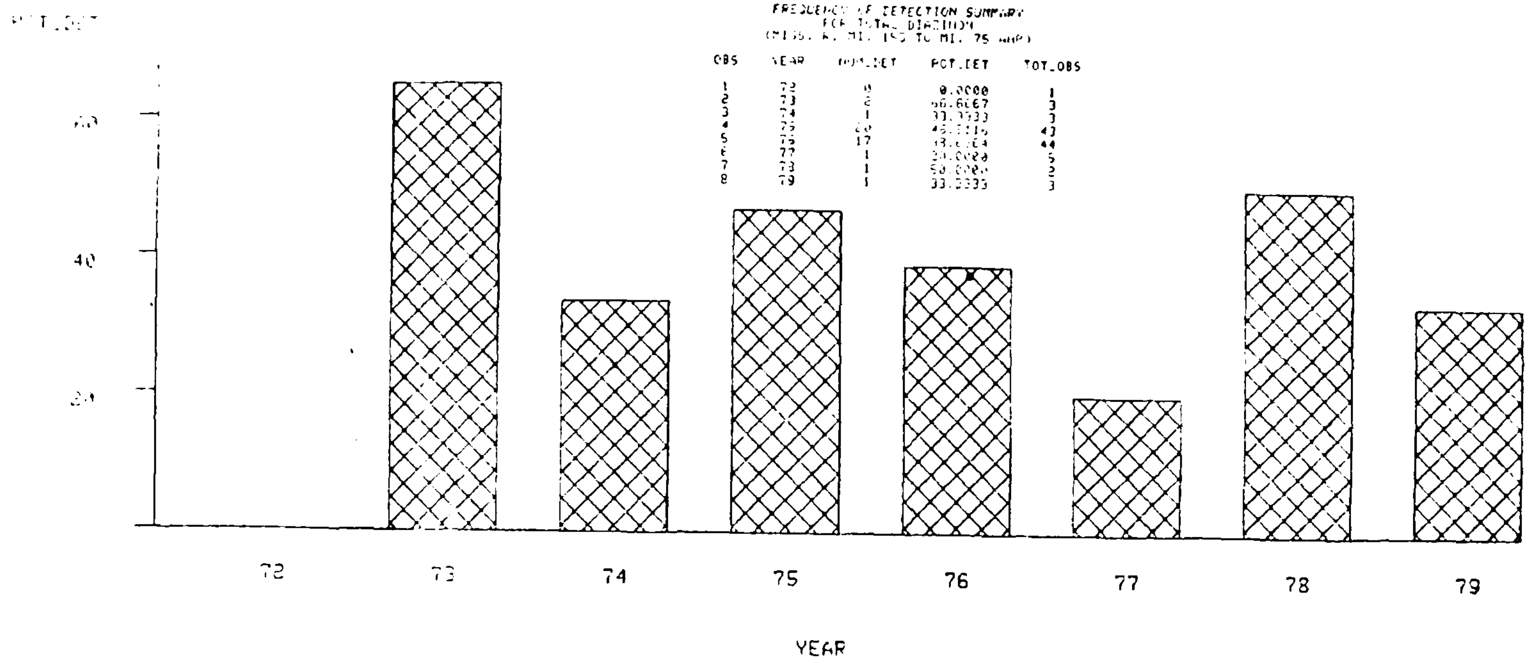
FREQUENCY OF DETECTION SUMMARY
FOR TOTAL 2,4-D
(MISS. R. MI. 155 TO MI. 75 AHP)

OBS	YEAR	NUM_DET	PCT_DET	TOT_OBS
1	72	0	0.000	1
2	73	2	66.667	3
3	74	0	0.000	4
4	75	27	65.854	41
5	76	35	79.545	44
6	77	2	40.000	5
7	78	2	100.000	2
8	79	1	50.000	2

(*MISS. R. MI.* 155 *TO MI.* 75 *AHP*)

PLATE H-12

FREQUENCY OF DETECTION HISTOGRAM FOR TOTAL DIAZINON

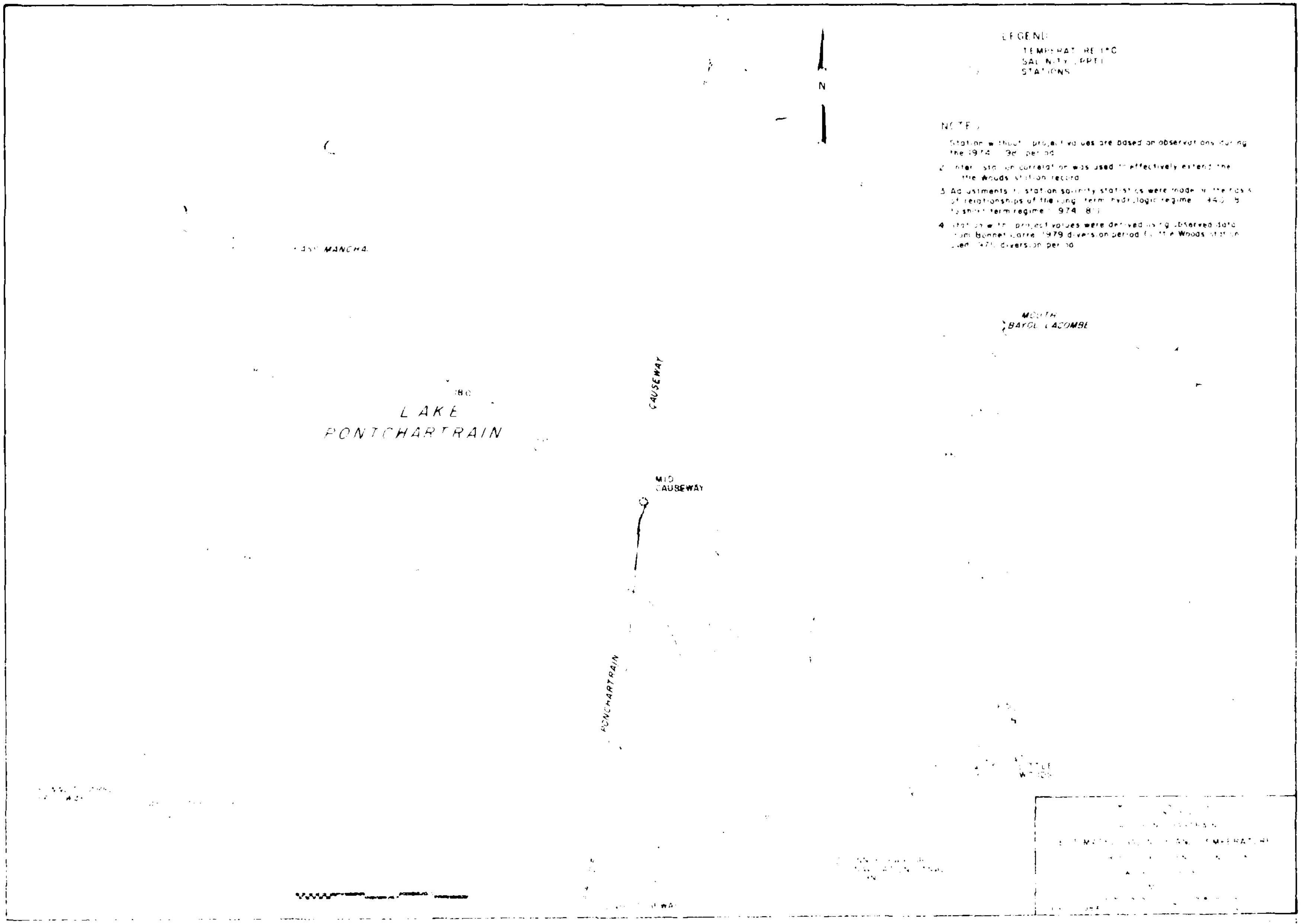


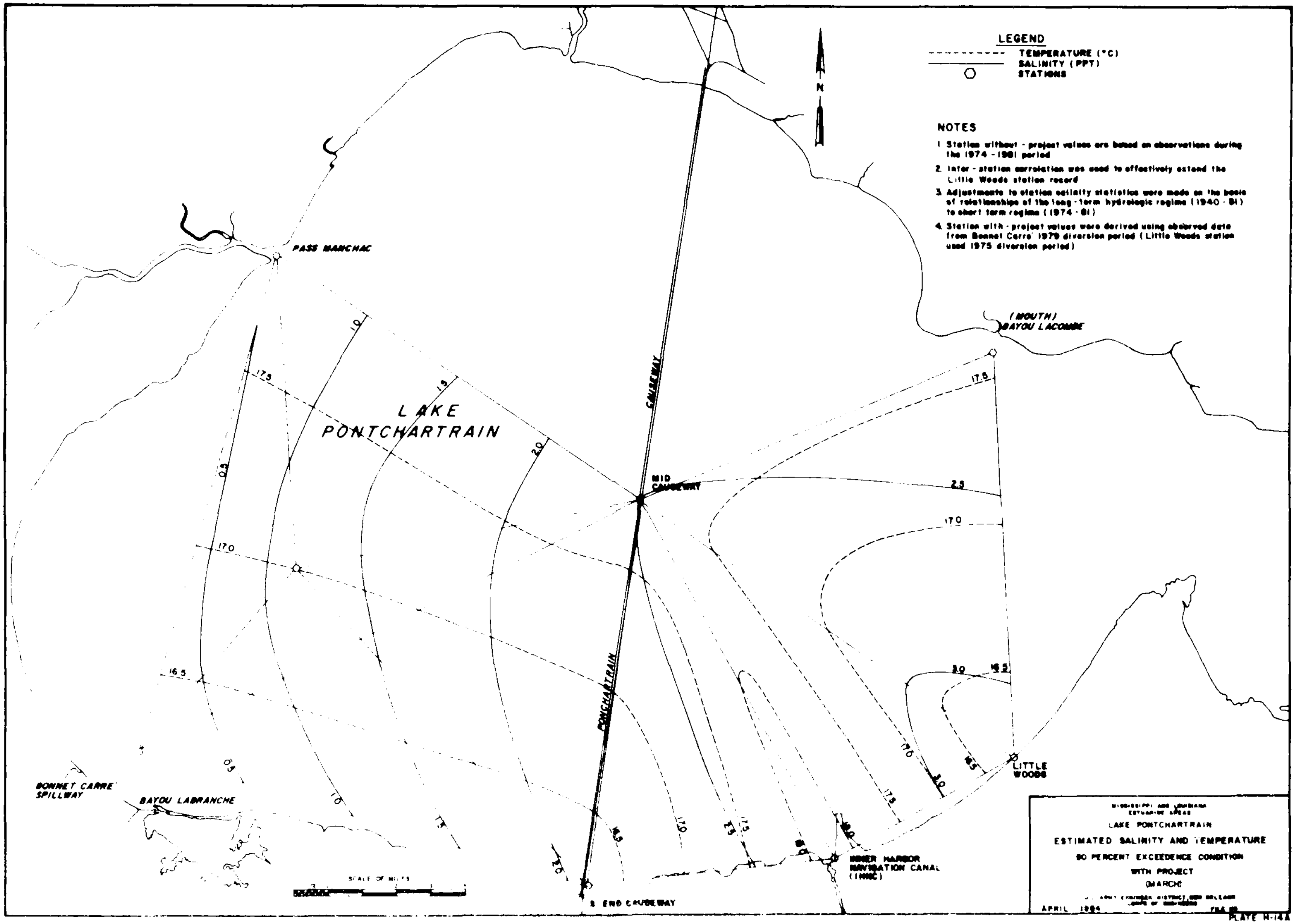
FREQUENCY OF DETECTION SUMMARY
FOR TOTAL DIAZINON
(MISS. R. MI. 155 TO MI. 75 AHP)

OBS	YEAR	NUM_DET	PCT_DET	TOT_OBS
1	72	0	0.0000	1
2	73	2	66.6667	3
3	74	1	33.3333	3
4	75	20	46.5116	43
5	76	17	38.6364	44
6	77	1	20.0000	5
7	78	1	50.0000	2
8	79	1	33.3333	3

(*MISS. R. MI.* 155 *TO MI.* 75 *AHP*)

PLATE H-13


LEGEND
TEMPERATURE (°C)
SALINITY (PPT)
STATIONS
NOTES
Station without project values are based on observations during the 1974 - 19__ period
2. Inter-station correlation was used to effectively extend the Little Woods station record
3. Adjustments to station salinity statistics were made on the basis of relationships of the long term hydrologic regime (194_-__) to short term regime (1974-81)
4. Stations with project values were derived using observed data from Bonnet Carre 1979 diversion period (Little Woods station used 1973 diversion period)
MOUTH BAYOU LACOMBE
CAUSEWAY
MID CAUSEWAY
LAKE PONTCHARTRAIN
PONTCHARTRAIN
EAST MANCHAC
N


LEGEND
TEMPERATURE (°C)
SALINITY (PPT)
STATIONS
NOTES
1 Station without - project values are based on observations during the 1974 - 1981 period
2 Inter - station correlation was used to effectively extend the Little Woods station record
3 Adjustments to station salinity statistics were made on the basis of relationships of the long - term hydrologic regime (1940 - 81) to short term regime (1974 - 81)
4 Station with - project values were derived using observed data from Bonnet Carre' 1979 diversion period (Little Woods station used 1975 diversion period)
N
PASS MANCHAC
LAKE PONTCHARTRAIN
CAUSEWAY
PONCHARTRAIN
MID CAUSEWAY
(MOUTH) BAYOU LACOMBE
LITTLE WOODS
INNER HARBOR NAVIGATION CANAL (IHNC)
S. END CAUSEWAY
BONNET CARRE' SPILLWAY
BAYOU LABRANCHE
SCALE OF MILES
LAKE PONTCHARTRAIN
ESTIMATED SALINITY AND TEMPERATURE
90 PERCENT EXCEEDENCE CONDITION
WITH PROJECT
(MARCH)
APRIL 1984
PLATE H-14A

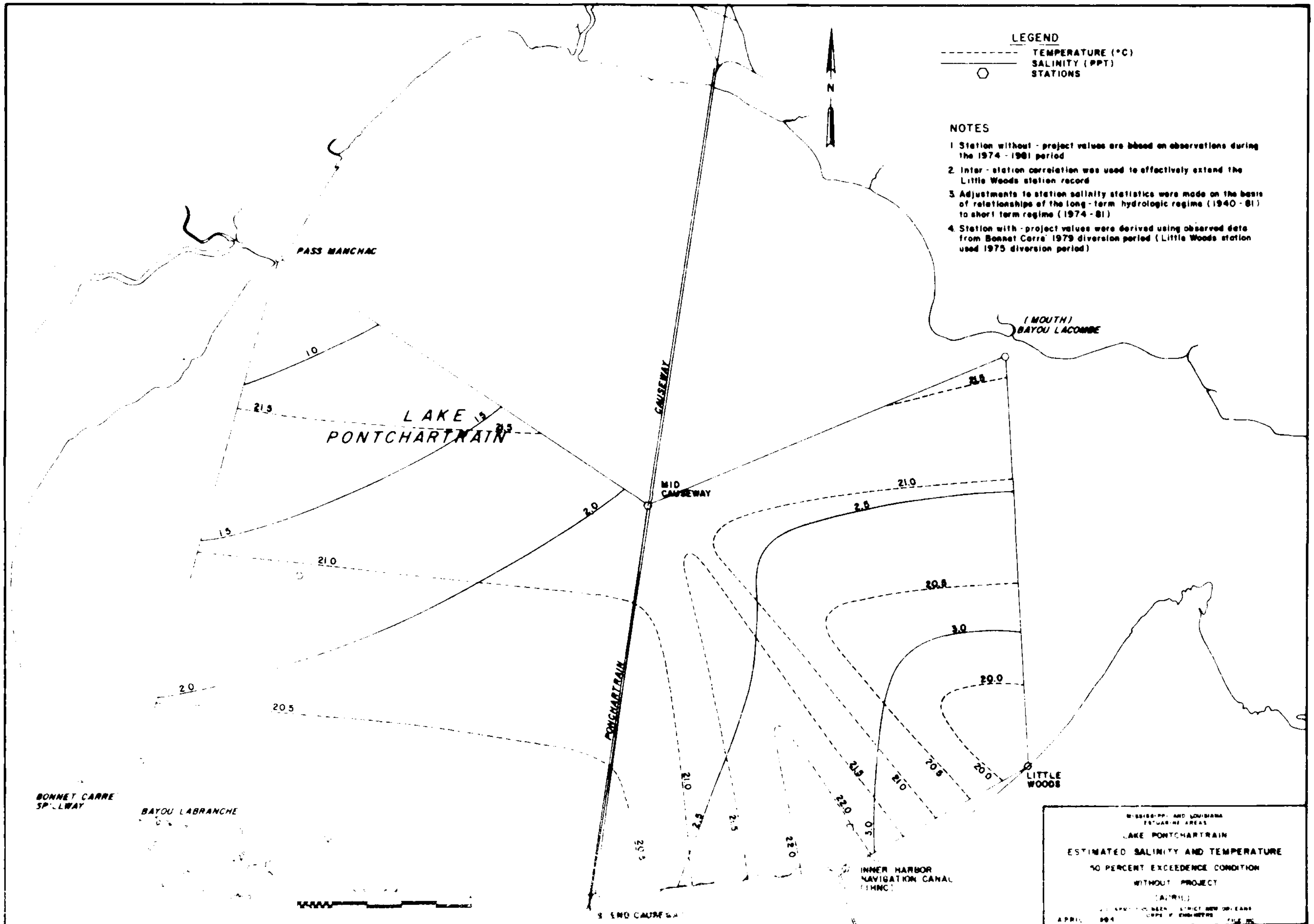
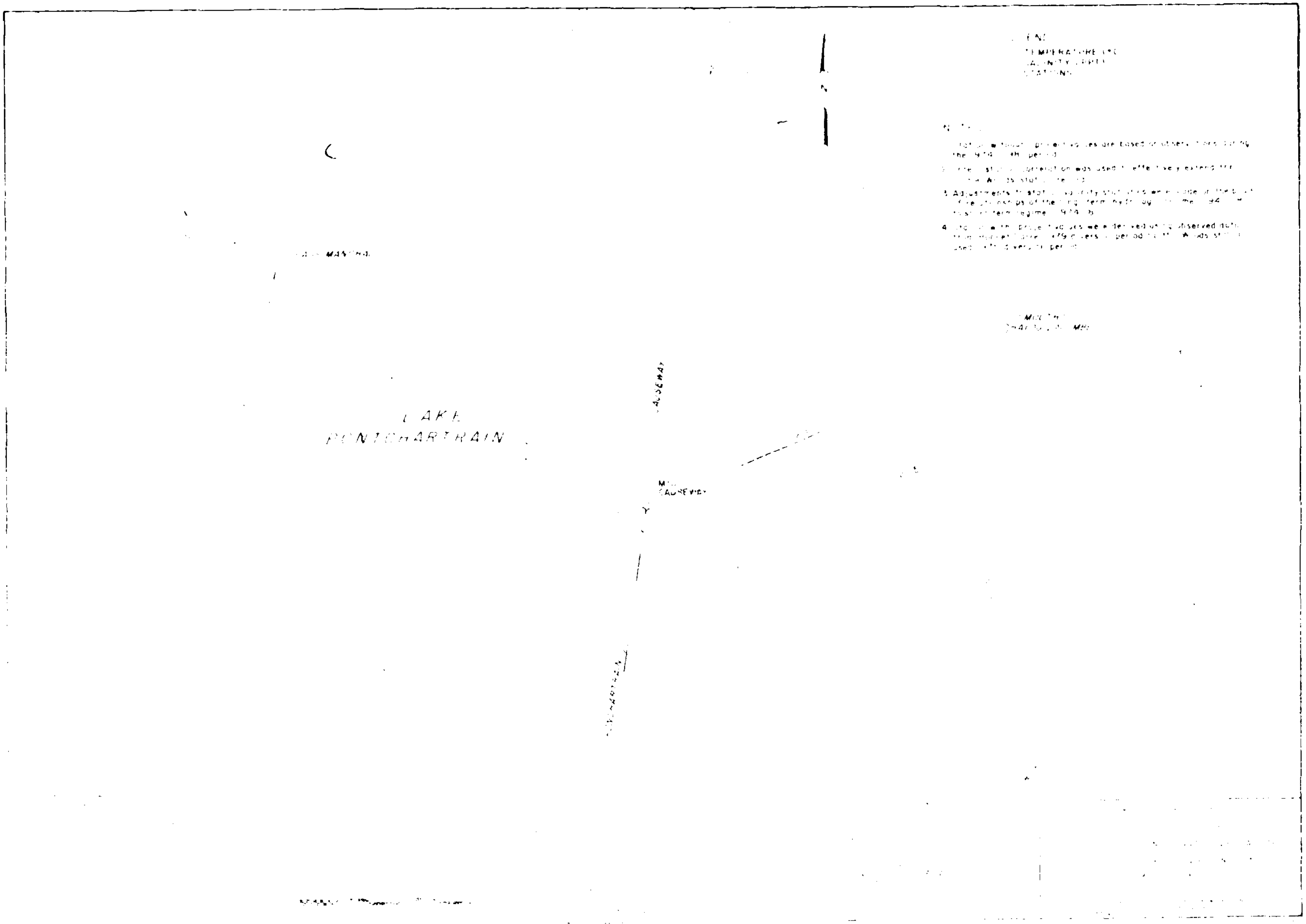

LEGEND
TEMPERATURE (°C)
SALINITY (PPT)
STATIONS
NOTES
1 Station without - project values are based on observations during the 1974 - 1981 period
2 Inter - station correlation was used to effectively extend the Little Woods station record
3 Adjustments to station salinity statistics were made on the basis of relationships of the long - term hydrologic regime (1940 - 81) to short term regime (1974 - 81)
4 Station with - project values were derived using observed data from Bonnet Carre' 1979 diversion period (Little Woods station used 1975 diversion period)
PASS MANCHAC
LAKE PONTCHARTRAIN
CAUSEWAY
PONTCHARTRAIN
MID CAUSEWAY
(MOUTH) BAYOU LACOMBE
LITTLE WOODS
INNER HARBOR NAVIGATION CANAL (IHNC)
S. END CAUSEWAY
BONNET CARRE SPILLWAY
BAYOU LABRANCHE
N
1.0
1.5
2.0
2.5
3.0
20.0
20.5
21.0
21.5
22.0
MISSISSIPPI AND LOUISIANA ESTUARINE AREAS
LAKE PONTCHARTRAIN
ESTIMATED SALINITY AND TEMPERATURE
50 PERCENT EXCEEDENCE CONDITION
WITHOUT PROJECT
(APRIL)

PLATE H-15


LAKE PONTCHARTRAIN
CAUSEWAY

channel would necessitate disposal into waters of the US and adjacent wetlands. The control structure itself would not be built in navigable waters or wetlands, nor would disposal from the inflow channel and most of the outflow channel be in such areas.

Recreational facilities consisting of breakwaters, launching ramps, courtesy piers, parking areas, and picnic tables would be built at six sites: Bonnet Carre', Frenier Beach, Rigolets, and Point Aux Herbes in Louisiana, and Cedar Point and Wolf River in Mississippi (see plate 3). Exact locations of these facilities are not known, but it is likely that a small amount of fill (less than 2 acres) would occur in navigable waters or wetlands at each site.

c. Project Authority. The Mississippi and Louisiana Estuarine Areas Study was authorized by a Resolution by the Committee on Public Works and Transportation of the US House of Representatives adopted on 23 September 1976.

d. General Description of Dredged or Fill Material

(1) General Characteristics of Material. Sediments in the general vicinity of the proposed complex are expected to consist of Holocene alluvium underlain by Pleistocene material. Top layers are of recent origin, laid down during spillway openings over the last forty years. The exact composition of the material to be dredged from the outflow channel is not known, but it would probably consist of layers of sand, silt, and clay with silt and clay predominating near the lake. The fill at the recreational sites would consist of concrete and asphalt.

(2) Quantity of Material. Approximately 2.2 million cubic yards (cy) of dredged material would be placed onto the disposal area

SECTION 404(b)(1) EVALUATION REPORT

Recommended Plan: Mississippi and Louisiana
Estuarine Areas Study

Freshwater Diversion to the Pontchartrain
Basin and Mississippi Sound

1. PROJECT DESCRIPTION

a. Location. The study area includes the Lakes Maurepas-Pontchartrain-Borgne Basin and Chandeleur Sound in southeastern Louisiana and Mississippi Sound and adajcent wetlands along the Mississippi gulf coast (see plate 1).

b. General Description. The primary objective of the proposed project is to divert fresh water from the Mississippi River to the Lakes Maurepas-Pontchartrain-Borgne Basin and Chandeleur and Mississippi Sounds. In years when design drought conditions would exist, the average monthly flow would be 9,844 cubic feet per second from March through November and the fresh water would retard saltwater intrusion, reduce the rate of land loss, and enhance wildlife and fishery production. The recommended plan to accomplish this consists of a multigated box culvert set in the Mississippi River levee about 30 miles upriver from New Orleans (see plate 2). The culvert would be immediately upstream from the existing Bonnet Carre' Floodway. A 950-foot inflow channel, a 6.4-mile outflow channel, a 1,450 by 1,020-foot sedimentation trap, and an access bridge would be built. A new guide levee would tie the Mississippi River Levee to the existing Upper Guide Levee of the floodway and thus inclose the outflow channel and the structure within the floodway. Construction of 1.5 miles of the outflow

MISSISSIPPI AND LOUISIANA ESTUARINE AREAS STUDY

Report on Freshwater Diversion

to the

Pontchartrain Basin and Mississippi Sound

Appendix I

SECTION 404(b)(1) EVALUATION REPORT

I.0.1. This appendix describes and evaluates the environmental impacts of discharging dredged material into waters of the project area in accordance with Section 404 of the Clean Water Act (CWA-PL95-217). The Section 404(b)(1) Guidelines (Title 40 CFR 230, as revised in 45 FR 85336-85357, December 24, 1980) were used without significant adaptation to evaluate the proposed dredged material discharge associated with the project. Information on the effects of the proposed dredged material discharge, including consideration of the Section 404(b)(1) Guidelines, is included in the Environmental Impact Statement (EIS) on the project.

LIST OF TABLES

LIST OF PLATES

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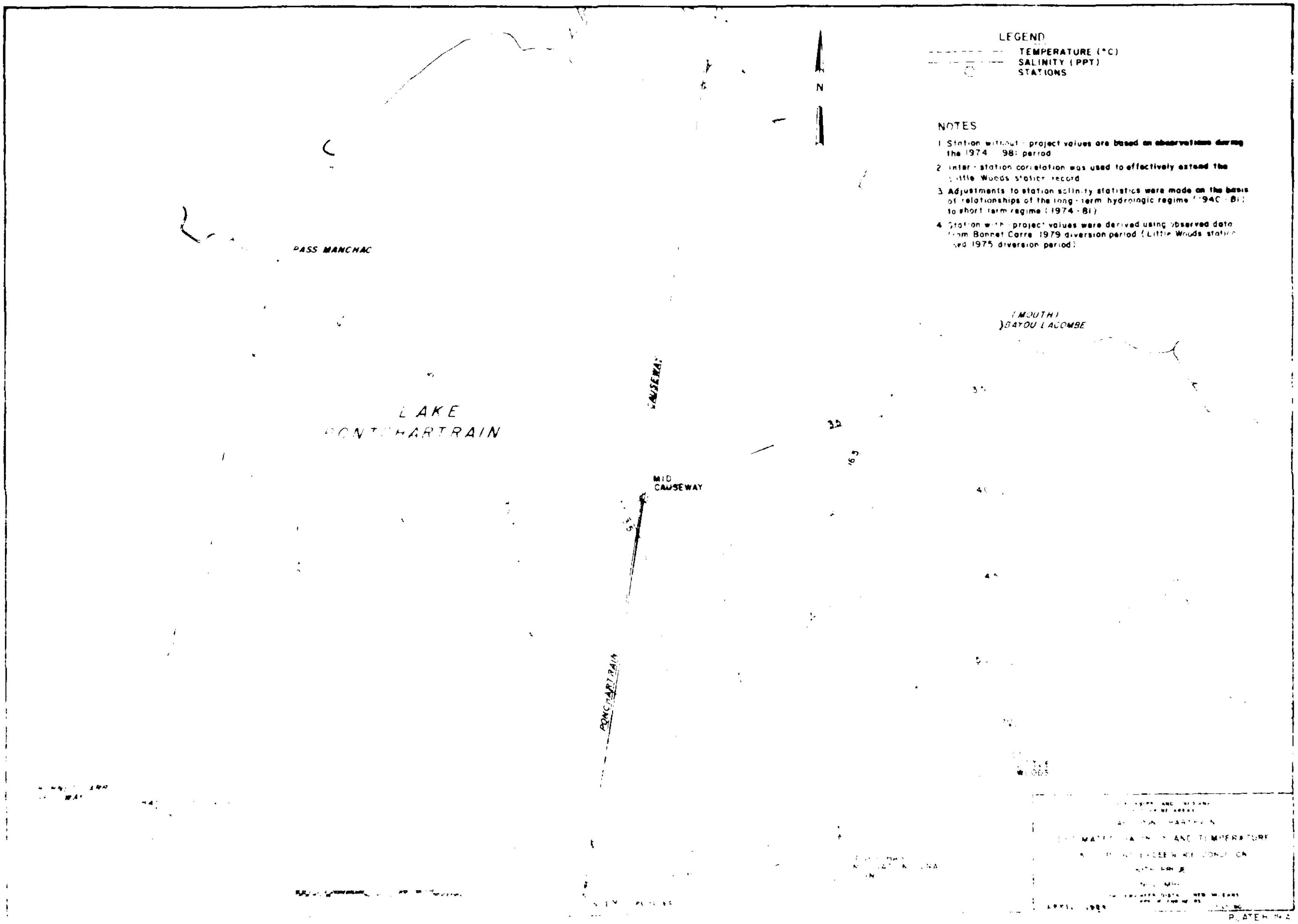
APPENDIX I

SECTION 404(b)(1) EVALUATION REPORT


LEGEND
TEMPERATURE (°C)
SALINITY (PPT)
STATIONS
N
NOTES
1 Station without - project values are based on observations during the 1974 - 98: period
2 Inter - station correlation was used to effectively extend the Little Woods station record
3 Adjustments to station salinity statistics were made on the basis of relationships of the long - term hydrologic regime (1940 - 81) to short term regime (1974 - 81)
4 Station with - project values were derived using observed data from Bonnet Carre 1979 diversion period (Little Woods station used 1975 diversion period)
PASS MANCHAC
(MOUTH)
BAYOU LACOMBE
LAKE
PONTCHARTRAIN
CAUSEWAY
MID
CAUSEWAY
PONCHARTRAIN
PLATE H-2

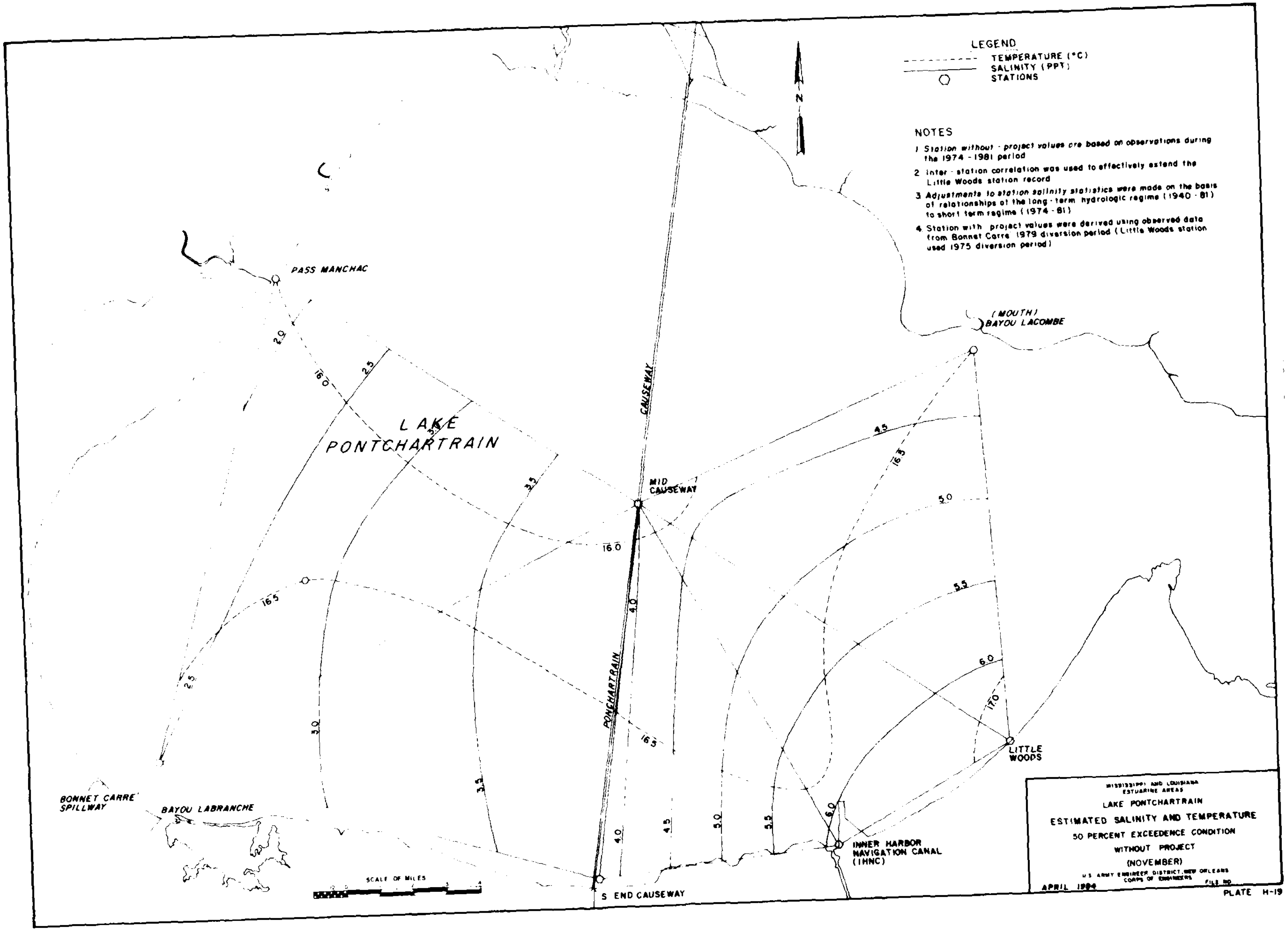
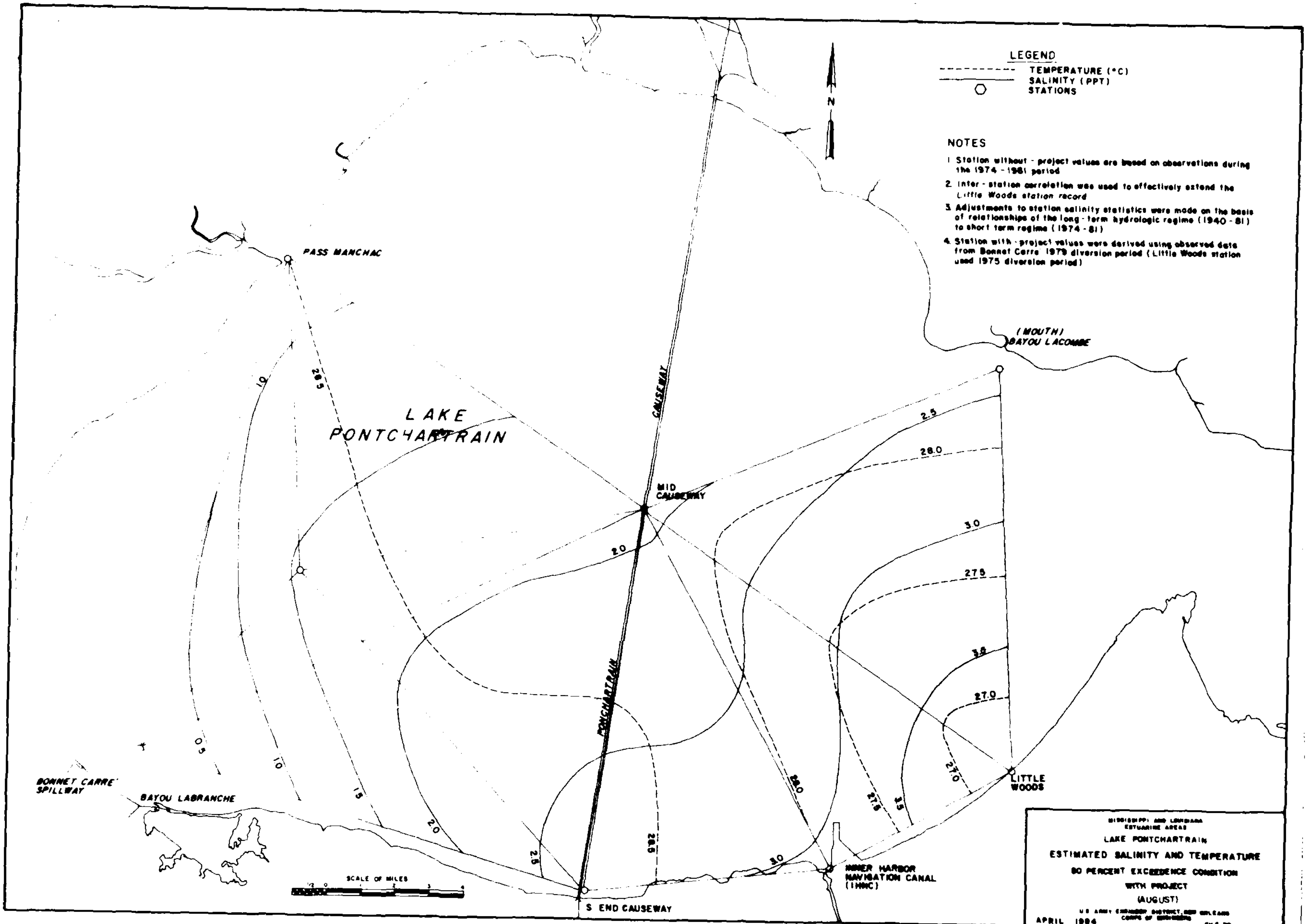
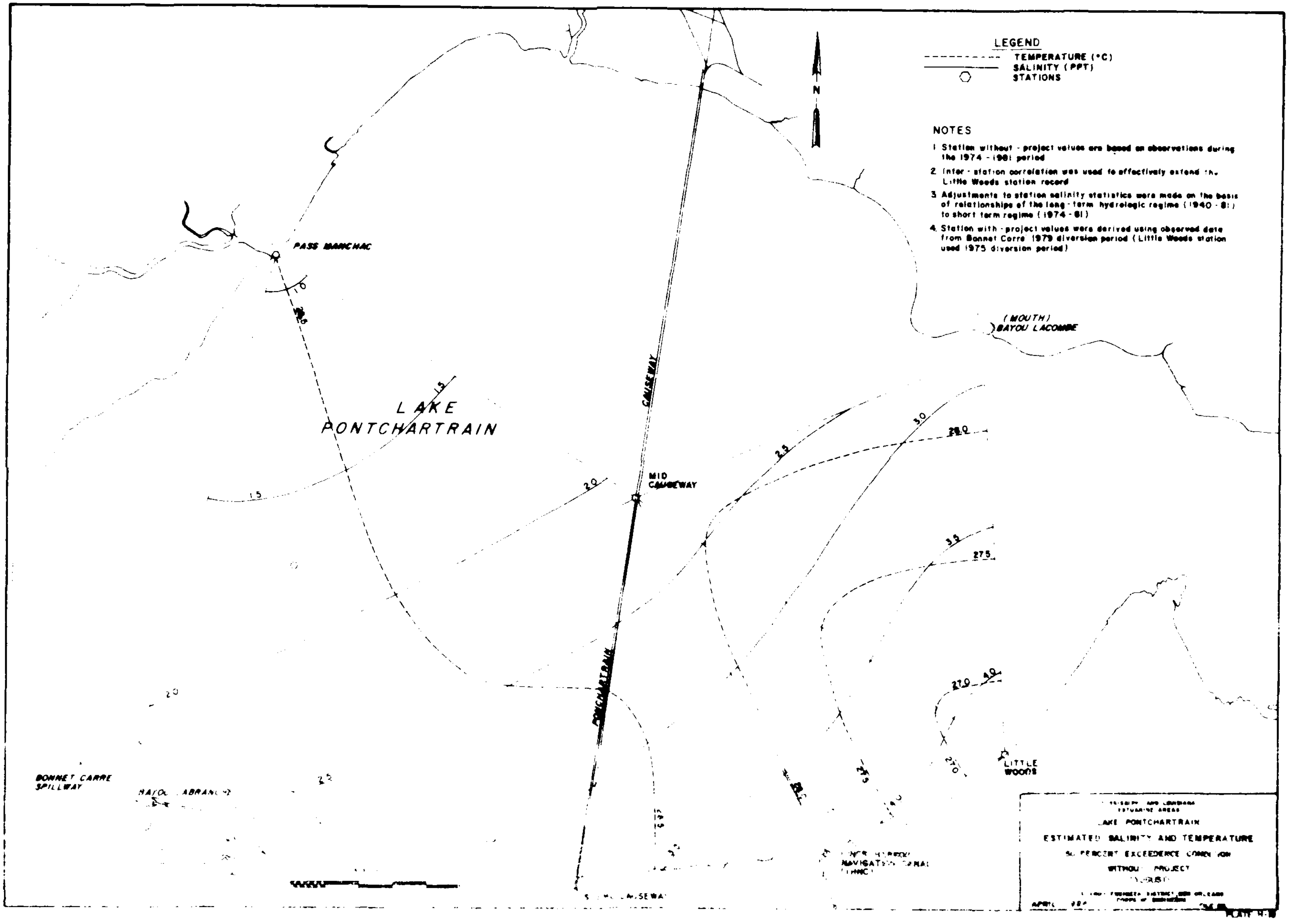

LEGEND
TEMPERATURE (°C)
SALINITY (PPT)
STATIONS
N
NOTES
1 Station without - project values are based on observations during the 1974 - 1981 period
2 Inter - station correlation was used to effectively extend the Little Woods station record
3 Adjustments to station salinity statistics were made on the basis of relationships of the long - term hydrologic regime (1940 - 81) to short term regime (1974 - 81)
4 Station with project values were derived using observed data from Bonnet Carre 1979 diversion period (Little Woods station used 1975 diversion period)
PASS MANCHAC
(MOUTH) BAYOU LACOMBE
LAKE PONTCHARTRAIN
CAUSEWAY
PONCHARTRAIN
MID CAUSEWAY
S END CAUSEWAY
LITTLE WOODS
INNER HARBOR NAVIGATION CANAL (IHNC)
BONNET CARRE SPILLWAY
BAYOU LABRANCHE
SCALE OF MILES
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
16.0
16.5
17.0
MISSISSIPPI AND LOUISIANA ESTUARINE AREAS
LAKE PONTCHARTRAIN
ESTIMATED SALINITY AND TEMPERATURE
50 PERCENT EXCEEDENCE CONDITION
WITHOUT PROJECT
(NOVEMBER)
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
APRIL 1984
FILE NO.

PLATE H-19



LEGEND
TEMPERATURE (°C)
SALINITY (PPT)
STATIONS
N
NOTES
1 Station without - project values are based on observations during the 1974 - 1981 period
2 Inter - station correlation was used to effectively extend the Little Woods station record
3 Adjustments to station salinity statistics were made on the basis of relationships of the long - term hydrologic regime (1940 - 81) to short term regime (1974 - 81)
4 Station with - project values were derived using observed data from Bonnet Carre 1979 diversion period (Little Woods station used 1975 diversion period)
PASS MANCHAC
LAKE PONTCHARTRAIN
CAUSEWAY
PONTCHARTRAIN
MID CAUSEWAY
(MOUTH) BAYOU LACOMBE
LITTLE WOODS
INNER HARBOR NAVIGATION CANAL (IHNC)
S END CAUSEWAY
BONNET CARRE' SPILLWAY
BAYOU LABRANCHE
SCALE OF MILES
2.5
28.0
3.0
27.5
3.5
27.0
28.5
2.0
1.5
1.0
0.5
LAKE PONTCHARTRAIN
ESTIMATED SALINITY AND TEMPERATURE
80 PERCENT EXCEEDENCE CONDITION
WITH PROJECT
(AUGUST)
APRIL 1984

PLATE H-18A


LEGEND
TEMPERATURE (°C)
SALINITY (PPT)
STATIONS
NOTES
1. Station without - project values are based on observations during the 1974 - 1981 period
2. Inter - station correlation was used to effectively extend the Little Woods station record
3. Adjustments to station salinity statistics were made on the basis of relationships of the long - term hydrologic regime (1940 - 81) to short term regime (1974 - 81)
4. Station with - project values were derived using observed data from Bonnet Carre 1979 diversion period (Little Woods station used 1975 diversion period)
N
PASS MANCHAC
LAKE PONTCHARTRAIN
CAUSEWAY
MID CAUSEWAY
PONTCHARTRAIN
(MOUTH) BAYOU LACOMBE
LITTLE WOODS
BONNET CARRE SPILLWAY
1.0
1.5
2.0
2.5
3.0
3.5
4.0
28.0
27.5
27.0
LAKE PONTCHARTRAIN
ESTIMATED SALINITY AND TEMPERATURE
WITHOUT PROJECT
APRIL

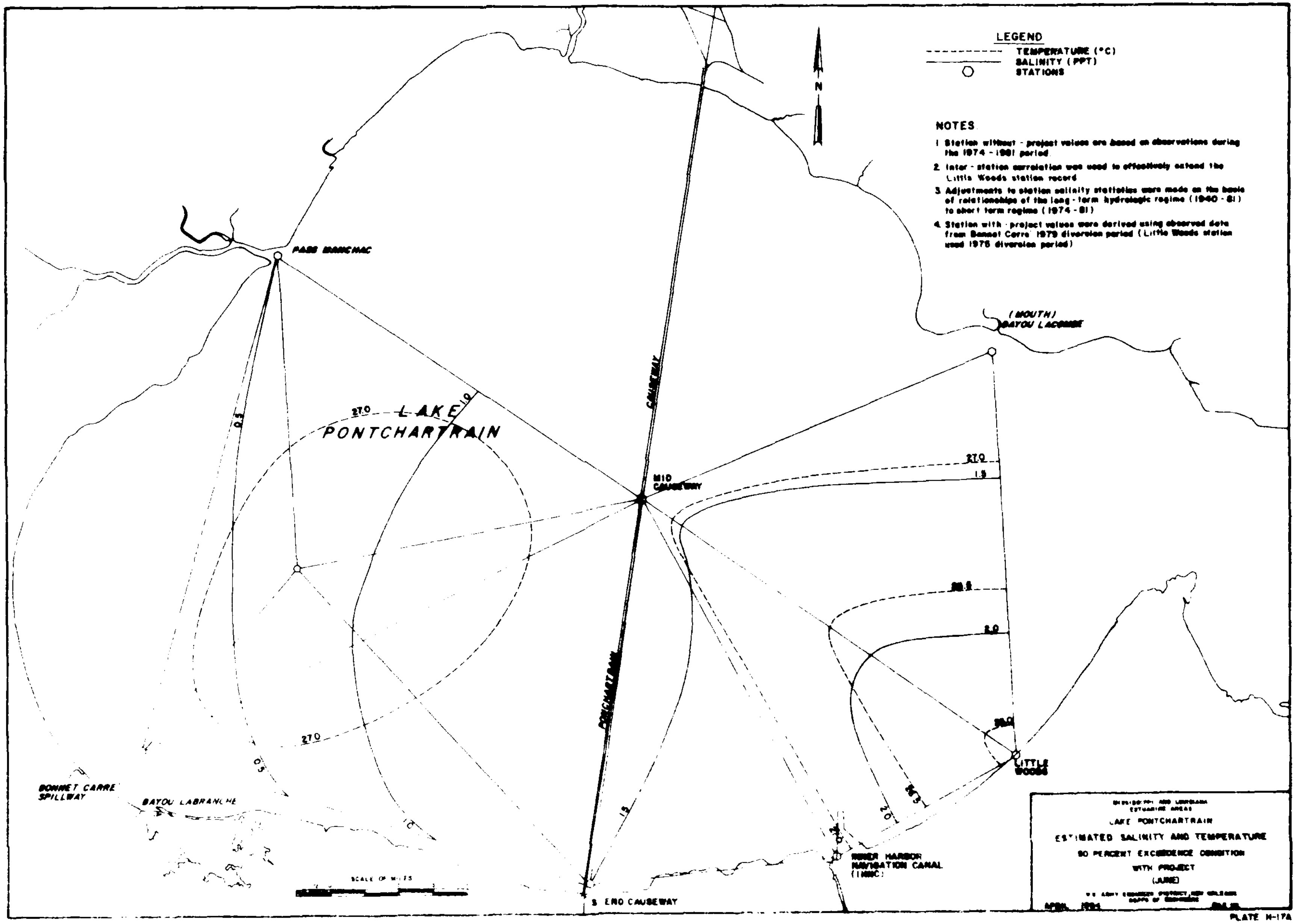
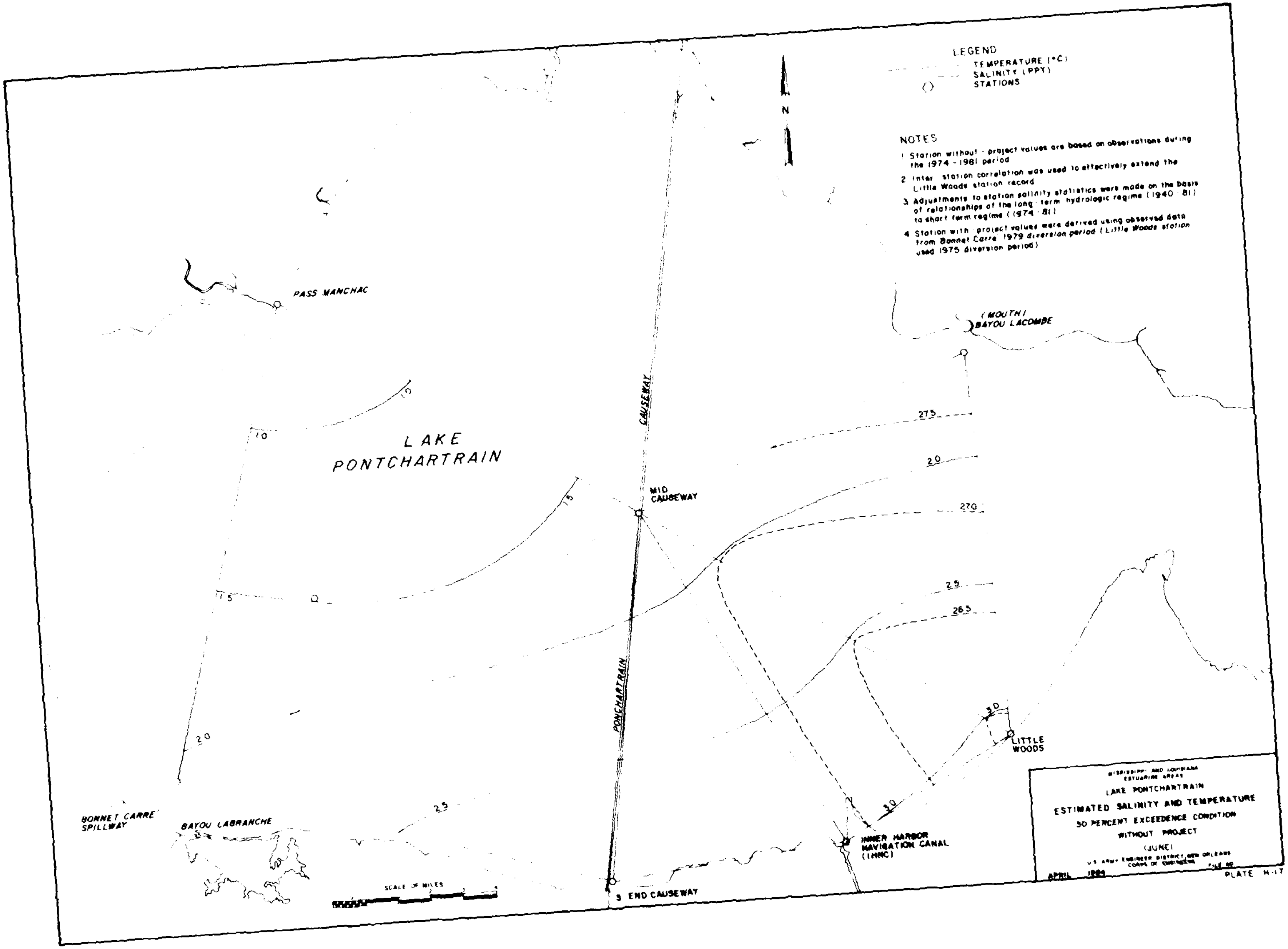
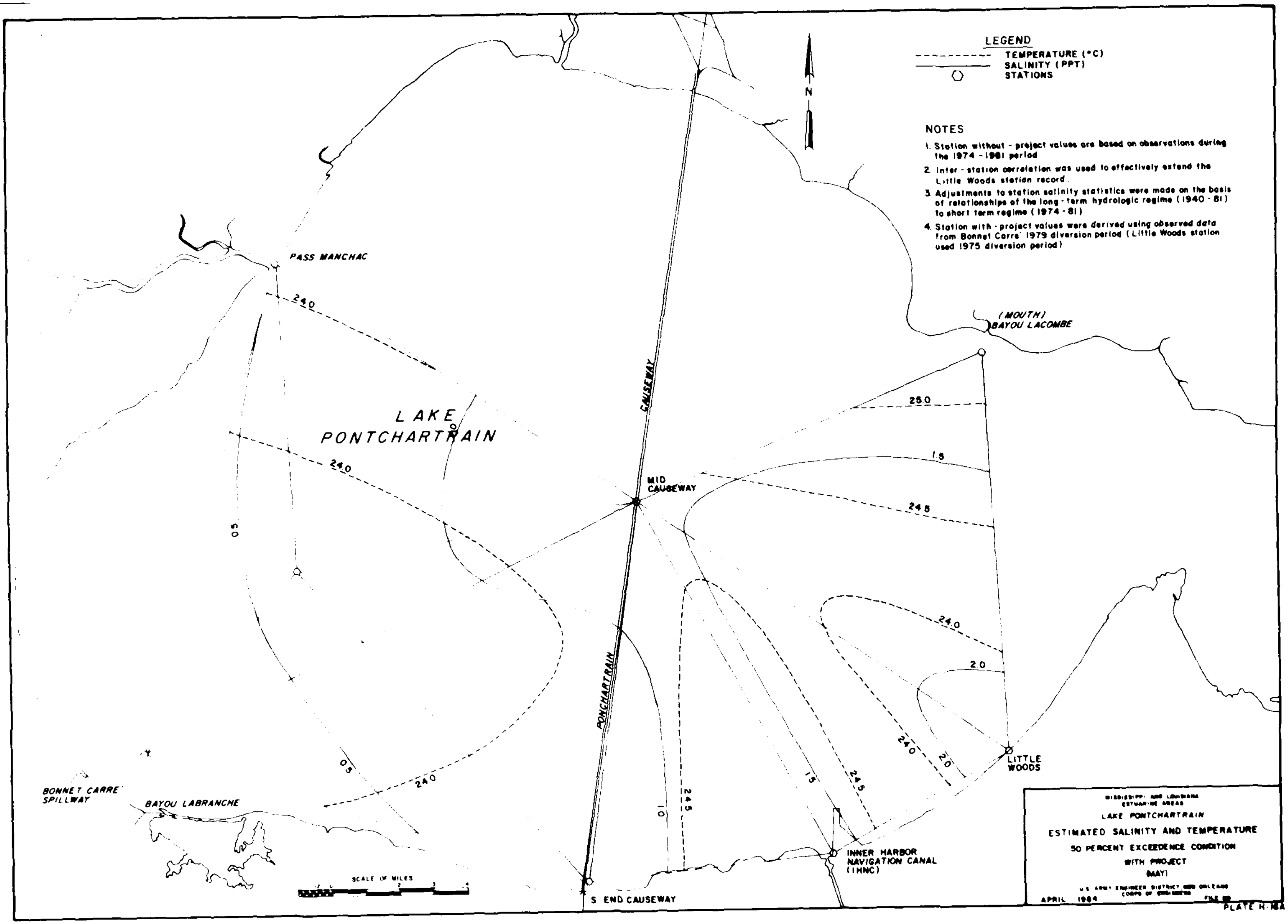
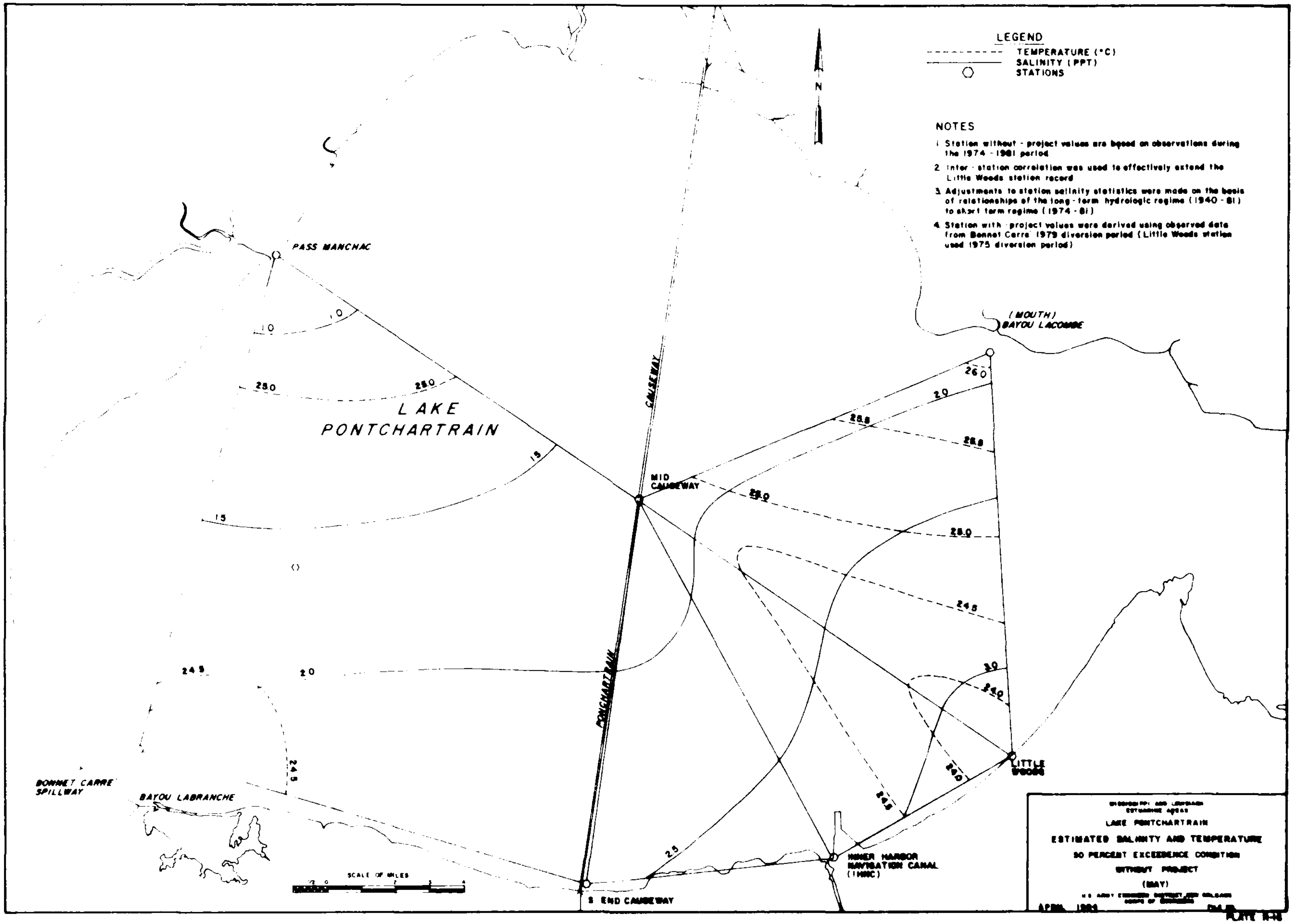

LEGEND
TEMPERATURE (°C)
SALINITY (PPT)
STATIONS
N
NOTES
1 Station without - project values are based on observations during the 1974 - 1981 period
2 Inter - station correlation was used to effectively extend the Little Woods station record
3 Adjustments to station salinity statistics were made on the basis of relationships of the long - term hydrologic regime (1940 - 81) to short term regime (1974 - 81)
4 Station with - project values were derived using observed data from Bonnet Carre' 1979 diversion period (Little Woods station used 1975 diversion period)
PASS MANCHAC
(MOUTH) BAYOU LACOMBE
LAKE PONTCHARTRAIN
CAUSEWAY
MID CAUSEWAY
PONTCHARTRAIN
S END CAUSEWAY
LITTLE WOODS
INNER HARBOR NAVIGATION CANAL (IHNC)
BONNET CARRE SPILLWAY
BAYOU LABRANCHE
SCALE OF MILES
27.0
1.0
0.5
1.5
2.0
28.5
LAKE PONTCHARTRAIN
ESTIMATED SALINITY AND TEMPERATURE
90 PERCENT EXCEEDENCE CONDITION
WITH PROJECT
(JUNE)
CORPS OF ENGINEERS
APRIL 1984

PLATE H-17A



LEGEND
TEMPERATURE (°C)
SALINITY (PPT)
STATIONS
N
NOTES
1 Station without - project values are based on observations during the 1974 - 1981 period
2 Inter - station correlation was used to effectively extend the Little Woods station record
3 Adjustments to station salinity statistics were made on the basis of relationships of the long - term hydrologic regime (1940 - 81) to short term regime (1974 - 81)
4 Station with - project values were derived using observed data from Bonnet Carre 1979 diversion period (Little Woods station used 1975 diversion period)
PASS MANCHAC
(MOUTH) BAYOU LACOMBE
LAKE PONTCHARTRAIN
CAUSEWAY
PONCHARTRAIN
MID CAUSEWAY
S. END CAUSEWAY
LITTLE WOODS
INNER HARBOR NAVIGATION CANAL (IHNC)
BONNET CARRE SPILLWAY
BAYOU LABRANCHE
SCALE OF MILES
10
10
15
15
20
25
27.5
20
27.0
25
26.5
30
30
LAKE PONTCHARTRAIN
ESTIMATED SALINITY AND TEMPERATURE
50 PERCENT EXCEEDENCE CONDITION
WITHOUT PROJECT
(JUNE)
APRIL
PLATE H-17


LEGEND
TEMPERATURE (°C)
SALINITY (PPT)
STATIONS
N
NOTES
1. Station without - project values are based on observations during the 1974 - 1981 period
2. Inter - station correlation was used to effectively extend the Little Woods station record
3. Adjustments to station salinity statistics were made on the basis of relationships of the long - term hydrologic regime (1940 - 81) to short term regime (1974 - 81)
4. Station with - project values were derived using observed data from Bonnet Carre' 1979 diversion period (Little Woods station used 1975 diversion period)
PASS MANCHAC
(MOUTH) BAYOU LACOMBE
LAKE PONTCHARTRAIN
PONTCHARTRAIN CAUSEWAY
MID CAUSEWAY
LITTLE WOODS
INNER HARBOR NAVIGATION CANAL (IHNC)
S. END CAUSEWAY
BONNET CARRE' SPILLWAY
BAYOU LABRANCHE
SCALE OF MILES
25.0
1.5
24.5
24.0
2.0
1.0
0.5
MISSISSIPPI AND LOUISIANA ESTUARINE AREAS
LAKE PONTCHARTRAIN
ESTIMATED SALINITY AND TEMPERATURE
50 PERCENT EXCEEDENCE CONDITION
WITH PROJECT
(MAY)
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
APRIL 1984
PLATE H-16A


LEGEND
TEMPERATURE (°C)
SALINITY (PPT)
STATIONS
NOTES
1. Station without - project values are based on observations during the 1974 - 1981 period
2. Inter - station correlation was used to effectively extend the Little Woods station record
3. Adjustments to station salinity statistics were made on the basis of relationships of the long - term hydrologic regime (1940 - 81) to short term regime (1974 - 81)
4. Station with - project values were derived using observed data from Bonnet Carre 1979 diversion period (Little Woods station used 1975 diversion period)
N
PASS MANCHAC
LAKE
PONTCHARTRAIN
CAUSEWAY
PONCHARTRAIN
MID CAUSEWAY
S END CAUSEWAY
(MOUTH) BAYOU LACOMBE
LITTLE WOODS
INNER HARBOR NAVIGATION CANAL (IHNC)
BONNET CARRE SPILLWAY
BAYOU LABRANCHE
SCALE OF MILES
10
10
25.0
25.0
15
15
2.0
24.5
24.5
26.0
2.0
25.5
25.5
25.0
25.0
24.5
3.0
24.0
24.0
24.5
2.5
LAKE PONTCHARTRAIN
ESTIMATED SALINITY AND TEMPERATURE
50 PERCENT EXCEEDENCE CONDITION
WITHOUT PROJECT
(MAY)

near Airline Highway and 1.5 million cy onto the disposal area near the lake (see plate 2). No maintenance dredging would be necessary in the lake nor in the outflow canal north of Airline Highway. Maintenance dredging would occur from the sediment trap and would be placed onto non-wetland areas. The exact amount of concrete and asphalt needed for the recreational areas is unknown, but would be relatively small.

(3) Sources of Material. The dredged material placed into the wooded swamp and open water would come from the adjacent outflow channel. The concrete and asphalt fill at the recreational sites would come from approved commercial sources.

e. Description of the Proposed Discharge Sites

(1) Location. The proposed disposal sites are located in Bonnet Carre' Floodway as shown on plate 2. The general area of discharge sites for the recreational features is located on plate 3.

(2) Size and Habitat Type. Approximately 25 acres of open water along the shore of Lake Pontchartrain and 488 acres of wooded swamp in the Bonnet Carre' Floodway would be filled with dredged material. The species in this swamp consist mainly of baldcypress, tupelogum, Drummond red maple, and green ash. No more than 12 acres of wetlands or navigable water would be impacted by recreational development.

(3) Types of Sites and Description of Construction Methods. The proposed dredging would be by bucket dragline and disposal into the swamp and open water would be unconfined. The material in the disposal area near Airline Highway would be available to the public, and it is expected that the sand would be removed for yard fill. The clay might be utilized in building levees or for blanketing land fill. Uses of

this fill that would affect other wetlands would require further Section 404 evaluation. The fill for the proposed recreational areas would be placed with appropriate equipment.

(4) Timing and Duration of Discharge. The timing of the proposed discharges would vary with the progress of work on individual features of the recommended plan. It is estimated that the freshwater diversion complex and recreational facilities could be completed within two years from the start of construction. Discharges would be intermittent during the construction periods.

2. FACTUAL DETERMINATIONS

a. Physical Substrate Determinations

(1) Effects on Substrate Elevation and Slope. Surface elevation at both sites in the Floodway is from 0 to 1 feet National Geodetic Vertical Datum (NGVD). Approximately 3-4 feet of dredged material would be placed onto the wooded swamp sites. However, as explained above, that material in the area near Airline Highway would be available to the public and some would probably be removed. The 25 acres of Lake Pontchartrain bottoms would have 2-3 feet of material placed on it. Modifications to elevation and slope in recreational areas would vary.

(2) Effects on Sediment Type. The dredged material that would be discharged during construction would be similar to the sediments that presently exist at the disposal sites.

(3) Effects Due to Dredged and Fill Material Movement. Significant movement of the bulk of the disposed material is unlikely. There

could be minor erosion along the outflow channel prior to establishment of vegetative cover, and substantial settlement might occur in areas where dredged material is piled. Tidal and current action in Lake Pontchartrain would rework sediments discharged into the open-water diposal site.

(4) Physical Effects on Benthos. Since dredged material would be deposited 2-3 feet deep over most of the open-water disposal area, benthic losses would be almost total, especially to the slow moving or sessile organisms such as chironomids, brackish water clams (*Rangia cuneata*) and the marsh periwinkle (*Littorina sphinctostoma*). As dragline deposition nears, mobile benthics, such as crabs, would tend to avoid the immediate impact areas. Repopulation of the open-water disposal area should occur within a short time, and species composition should be similar to predisposal conditions. Benthic losses in the wooded swamp would be total as 3-4 feet of dredged material would be placed onto it. Existing benthic populations of snails, chironomids, and some other organisms would be destroyed. As the public removes the dredged material, the elevation might again revert to 0-1 feet NGVD and it is possible that some benthic populations might re-enter the area. Benthic losses where boat launch ramps and parking lots would be placed would be total and no repopulation would occur.

(5) Actions Taken to Minimize Impacts. Use of bucket draglines would minimize the area impacted by construction activities.

b. Water Circulation, Fluctuation, and Salinity Determinations

(1) Effects on Water.

(a) Salinity. Disposal of dredged material would not affect salinities. Effects on salinity due to operation of the proposed structure are discussed in the project's Environmental Impact Statement.

(b) Water Chemistry. Factors such as increased turbidity, release of organic material, chemical leaching, and possible depression of dissolved oxygen levels could contribute to a possible minor acidic shift in the pH of the water in the disposal areas. Oxidation of reduced, water logged, sulfide-bearing sediments could result in the slow leaching of acid drainage waters from stockpiled dredged material to the adjacent wetlands. Generally, the buffering capacity of the wetland surface waters would be sufficient to retard radical shifts in pH. In general, it is anticipated that changes in water chemistry resulting from disposal would be minor and limited to the fringes of the disposal areas.

(c) Clarity. Surface water clarity of the outflow canal and the adjacent wetlands would be significantly reduced during discharge. This condition would be improved upon completion of construction. However, the outflow canal would appear more like the Mississippi River than the present borrow pit whenever the structure is operated.

(d) Color. The apparent color of the surface waters adjacent to the discharge sites would be intensified significantly by discharge operations, and the true color of these waters may also intensify.

(e) Odor. Mounding of dredged sediments containing sulfide would temporarily release foul odors until the material is fully oxidized.

(f) Dissolved Gas Levels. Gases of aerobic or anaerobic bacterial respiration (CO_2, CH_4, N_2, H_2S, etc.) could increase in the surface waters at the discharge sites. The dissolved oxygen (DO) in these waters would likely be depressed or depleted. Un-ionized ammonia concentrations might increase also. Any modification of dissolved gas levels would be localized (e.g., at the fringes of stockpiled dredged material) and short term.

(g) Nutrients and Eutrophication. Characteristically, water column nitrogen concentrations increase substantially during dredge and fill operations. However, the attendant increased levels of suspended solids, and apparent true color, act to limit the depth of the photic zone and thereby inhibit abundant algal growth. Phosphorus is released from suspended dredged sediments to a much lesser extent, if at all. Normally, phosphorus compounds remain associated with finely divided suspended solids if oxidizing conditions are maintained. Nutrients released to the water column would eventually be recycled to sediments. Since the construction activity would be of relatively short duration, significant enrichment of adjacent swamps or Lake Pontchartrain would not be anticipated due to dredged-material disposal. Effects due to project operation are presented in the Environmental Impact Statement.

(2) Effects on Current Patterns and Circulation

(a) Current Patterns and Flow. Disposal into the wooded swamp near Airline Highway would slightly alter local current patterns. After settlement or removal by the public, existing patterns should return. Disposal into the area near and into Lake Pontchartrain would permanently alter current patterns to a minor degree. Fill in the recreational areas would have essentially no impact on current patterns.

(b) Velocity. No effect.

(c) Stratification. No effect.

(d) Hydrologic Regime. Net flow has previously been interrupted by the guide levees. The proposed disposal of dredged material would have little additional effect.

(3) Effects on Normal Water Level Fluctuations. No effect.

(4) Effects on Salinity Gradients. No effect due to dredged-material disposal.

(5) Actions Taken to Minimize Impacts. Since only a minor amount of dredged material would be disposed into an open-water area, there would be essentially no impacts on water circulation, fluctuation, or salinity regimes.

c. Suspended Particulate/Turbidity Determinations

(1) Expected Changes in Suspended Particulates and Turbidity Levels in the Vicinity of the Construction Sites. Both suspended particulate and turbidity levels would increase substantially in the surface waters adjacent to the discharge sites during dredging, but would decline rapidly after completion of construction.

(2) Effects on the Chemical and Physical Properties of the Water Column.

(a) Light Penetration. Light penetration, and thus the depth of the photic zone, would be temporarily decreased as a result of increased suspended particulates and turbidity during discharge operations.

(b) Dissolved Oxygen. DO levels near the discharge sites could be temporarily depressed or depleted.

(c) Toxic Metals and Organics. The sediments proposed for disposal originate both from deposition by the Mississippi thousands of years ago and from deposition during spillway openings. Sediments deposited prior to industrialization of the area would not contain unnatural levels of harmful metals or organics. However, top layer sediments may be recent enough to contain pollutants. During 1973-1975, nearly 5 million cubic yards of sediment left by two spillway openings had to be removed from the floodway. Therefore, a worst-case approach to the chemical quality of these sediments would be to equate them with Mississippi River suspended sediment load. However, sediments deposited in the floodway would average much larger grain size than typical river suspended sediment. These sand-size particles tend to be relatively clean of pollutants. Samples of floodway sediments taken in 1981 support this conclusion. No organics were detected. Metal data are shown in table I-1. Compared to Mississippi River sediment levels, only the maximum values for chromium, copper, and nickel are above average river sediment values. All values are within the ranges found in Mississippi River sediment. Therefore, no significant impact due to release of particulates during the construction would be expected.

(d) Pathogens. Material discharge would temporarily increase water column bacterial densities. Levels would return to normal before the affected water impacted either humans or oysters.

(e) Esthetics. Unsightly turbidity plumes would be caused by solids placed in suspension during discharge operations. These plumes would not persist long after the completion of construction.

TABLE I-1

1981 TOXIC METAL DATA BASED ON SEDIMENT SAMPLES
FROM BONNET CARRE' FLOODWAY

Toxic Metal	Range in floodway Sediment (ug/g)
Manganese	256-381
Iron	13,000-24,100
Mercury	0.1-0.6
Lead	7.7-14.0
Zinc	40-80
Chromium	19-40
Cadmium	<0.09-0.20
Copper	8-19
Nickel	14-25
Arsenic	2.7-7.4

(3) Effects on Biota.

(a) Primary Production, Photosynthesis. Some phytoplankton would be destroyed by turbidity in areas adjacent to discharge sites. Localized turbidity increases adjacent to discharge sites would also limit light penetration, but should not significantly affect photosynthesis due to the short duration of impact. Increased nitrogen levels could contribute to a bloom condition, but since construction would be of short duration and nitrogen would be recycled back into the sediments, eutrophic conditions should not become a problem.

(b) Suspension/Filter Feeders. Filter feeders outside the disposal areas would experience very little mortality due to turbidity.

(c) Sight Feeders. Impacts on sight feeders such as largemouth bass, spotted seatrout, and other fishes would be minimal. Turbidity increases outside of discharge areas which could impair feeding or other processes would be very localized, short term, and of no major consequence.

(4) Actions to Minimize Impacts of Suspended Particulates/Turbidity. Normal sediment control provisions for general protection of the environment would be included in all construction contract specifications.

d. Contaminant Determinations. The discharge of dredged material can change the chemistry and the physical characteristics of the receiving water at the disposal site through the introduction of chemical constituents in suspended or dissolved form (US EPA, 1980).

However, previous studies completed through the Army Corps of Engineers Dredged Material Research Program (DMRP), have concluded that he overall potential for mobilization or release of constituents from dredged sediments to the water column, in either dissolved or suspended form, is directly associated with the degree of physicochemical change in the disposal site conditions over those experienced in the predredged sediments (Saucier, et al., 1978).

Of the many potential impacts associated with dredged-material disposal practices investigated through the DMRP, mobilization, release, and bioavailability of chemical constituents from contaminated dredged sediments has proven to be the overall concern associated with inland and marine disposal activities in the United States. Of the potential contaminants associated with bed sediments in an aqueous environment, those of greatest concern in evaluating potential ecological and/or human health impacts associated with dredged-material disposal have been considered to be toxic metals, certain organic compounds, and biostimulants.

Piling of 2.2 million cubic yards of dredged material along the outflow canal north of Airline Highway to heights of 3-4 feet would allow much of the material to oxidize. Toxic metals adsorbed to the material would then be expected to mobilize and migrate to the adjacent swamps or the outflow canal. Since these metals would not be expected to be present in elevated concentrations (see Section II.C.2.c.), no significant contamination should result.

Sediment disposed in Lake Pontchartrain would remain in a reduced physicochemical condition; therefore, no additional contaminant impacts should result.

e. Aquatic Ecosystem and Organism Determinations

(1) Plankton Effects. Effects of turbidity on phytoplankton are discussed in Paragraph 2.c.(3)(a) on page I-12. Some zooplankton and phytoplankton would be destroyed in the open water and swamp disposal areas as they are carried to the bottom by the dredged material. Some zooplankton at the periphery of the disposal areas would be destroyed by turbidity. A minor amount of plankton would be destroyed by fill operations for recreational areas.

(2) Benthos Effects. Effects due to disposal are discussed in Paragraph 2.a.(4) on page I-6, and effects due to turbidity are discussed in Paragraph 2.c.(3)(b) on page I-12.

(3) Nekton Effects. Most species would not be directly affected by the disposal operations since they would avoid the disposal area during construction. The open-water disposal would temporarily eliminate some feeding area for benthic feeders. Effects of turbidity on nekton are discussed in Paragraph 2.c. (3)(c) on page I-12.

(4) Aquatic Food Web Effects. Some increases in littoral habitat may be expected adjacent to open-water discharge sites. Dredged-material discharge would temporarily displace forage fish species such as menhaden, bay anchovy, tidewater silversides, and Altantic croaker from their normal spawning and feeding areas. Impacts of disposal on the food web are considered minimal.

(5) Special Aquatic Sites Effects.

(a) Effects on Wetlands. Changes in substrate elevation would permanently destroy the wetland qualities of the

wooded swamp disposal areas. The dredged material would revegetate with grass, then scrub-shrub, and finally bottomland hardwoods. The material in the site near Airline Highway would be available to the public; so the area would be periodically disturbed and thus remain in a scrub-shrub or early successional bottomland hardwood stage. The site near the lake probably would succeed to bottomland hardwoods during the life of the project. The wetland character of areas filled for recreational sites would be permanently lost.

(6) Threatened or Endangered Species. No effect.

(7) Other Wildlife. Wildlife species such as nutria, swamp rabbit, and some birds might benefit because of the higher ground created by dredged-material discharges. Losses to wildlife would be considered minor.

f. Proposed Disposal Site Determinations.

(1) Mixing Zone Determinations. No significant point levels of pollutants are anticipated. The small releases which could occur would be expected to dilute immediately due to natural mixing.

(2) Determination of Compliance with Applicable Water Quality Standards. Louisiana water quality standards applicable to surface waters near the proposed discharge sites are presented in Table I-2. It is anticipated that the DO standard might be violated during dredged-material discharge. It is unlikely that the proposed construction would cause violations of the other standards listed.

(3) Potential Effects on Human Use Characteristics.

(a) Municipal and Private Water Supply. No effect.

(b) Recreational and Commercial Fisheries. Sport and ommercial fisheries should not be significantly impacted by dredged-aterial discharges. Fish would generally avoid the disposal areas, nd thus some recreational fishing would be temporarily disrupted. ccess for commercial and recreational fisherman would be increased by he boat launches and piers.

(c) Water-Related Recreation. The only impact on water ased recreation would be the access provided by the recreational reas.

(d) Esthetics. During construction, the environment at nd near the proposed disposal sites would be esthetically displeasing o some individuals due to noise, turbidity, and unvegetated sand and lay. Upon cessation of construction, revegetation of the terrestrial reas should start within one growing season and continue until nterrupted by individuals removing sand or clay.

(e) Parks, National and Historical Monuments, National eashores, Wilderness Areas, Research Sites, and Similar Preserves. o effect.

g. Cumulative and Secondary Effects on the Aquatic Ecosystem. umulative effects of wetland disposal of 2.2 million cubic yards and pen-water and wetland disposal of 1.5 million cubic yards would be inimal. Much of the disposed material would be removed by the public r washed away during openings of the Bonnet Carre' Spillway. emaining dredged material would eventually settle and subside back to ormal elevations. When the floodway is opened, material may be arried from the wooded swamp disposal areas into adjacent swamp. It s not possible to quantify the amount of acreage to be affected, but

t should not be a significant amount. The construction of the utflow channel would destroy 38 acres of open-water areas and 130 cres of wooded swamp.

TABLE I-2

LOUISIANA STATE WATER QUALITY STANDARDS

'arameter	Lake Pontchartrian - West of Highway 11 Bridge
:hlorides, mg/l	N/A
;ulfates, mg/l	N/A
)issolved Oxygen mg/l	4.0
ɔH, standard units	6.5 to 9.0
Temperature, degrees Celsius	35
Total Dissolved Solids, mg/l	N/A

AD-A152 725 MISSISSIPPI AND LOUISIANA ESTUARINE AREAS FRESHWATER DIVERSION TO LAKE PO..(U) ARMY ENGINEER DISTRICT NEW ORLEANS LA D L CHEW APR 84 6/6

UNCLASSIFIED F/G 13/2 NL

END

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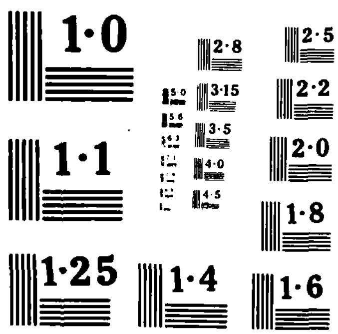

1·0
2·8
2·5
3·15
2·2
3·5
1·1
2·0
4·0
4·5
1·8
1·25
1·4
1·6

3. FINDING OF COMPLIANCE FOR THE RECOMMENDED MISSISSIPPI AND LOUISIANA ESTUARINE AREAS STUDY FRESHWATER DIVERSION TO THE PONTCHARTRAIN BASIN AND MISSISSIPPI SOUND

a. No significant adaptations of the guidelines (40 CFR 230) were made relative to this evaluation.

b. The recommended plan would have the least amount of adverse impact upon the aquatic ecosystems compared to other available practical alternatives. Violations of the Louisiana State Water Quality Standards could occur for DO concentrations in shallow waters adjacent to the construction sites. However, these violations, should they occur, would be highly localized and of short duration. Section 307 of the Clean Water Act has never been adopted by the State of Louisiana.

c. Use of the proposed disposal sites would not harm any endangered or threatened species or their critical habitat nor violate protective measures for any marine sanctuary.

d. The proposed construction would not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreational and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. The life stages of aquatic organisms and other wildlife would not be adversely affected. Significant adverse effects upon aquatic ecosystem diversity, productivity and stability; and recreational, esthetic and economic values would not occur. Adverse effects that could occur as a result of the proposed dredged-material discharge would not be significant.

e. Appropriate steps to minimize potential adverse impacts include the use of dragline dredging in lieu of hydraulic dredging where appropriate, and incorporation of provisions for environmental protection in contracts for construction.

f. On the basis of the application of the guidelines (40 CFR 230), the sites designated for dredged-material discharge are specified as complying with the requirements of these guidelines with inclusion of practical conditions to minimize pollution or adverse effects to the affected aquatic ecosystem.

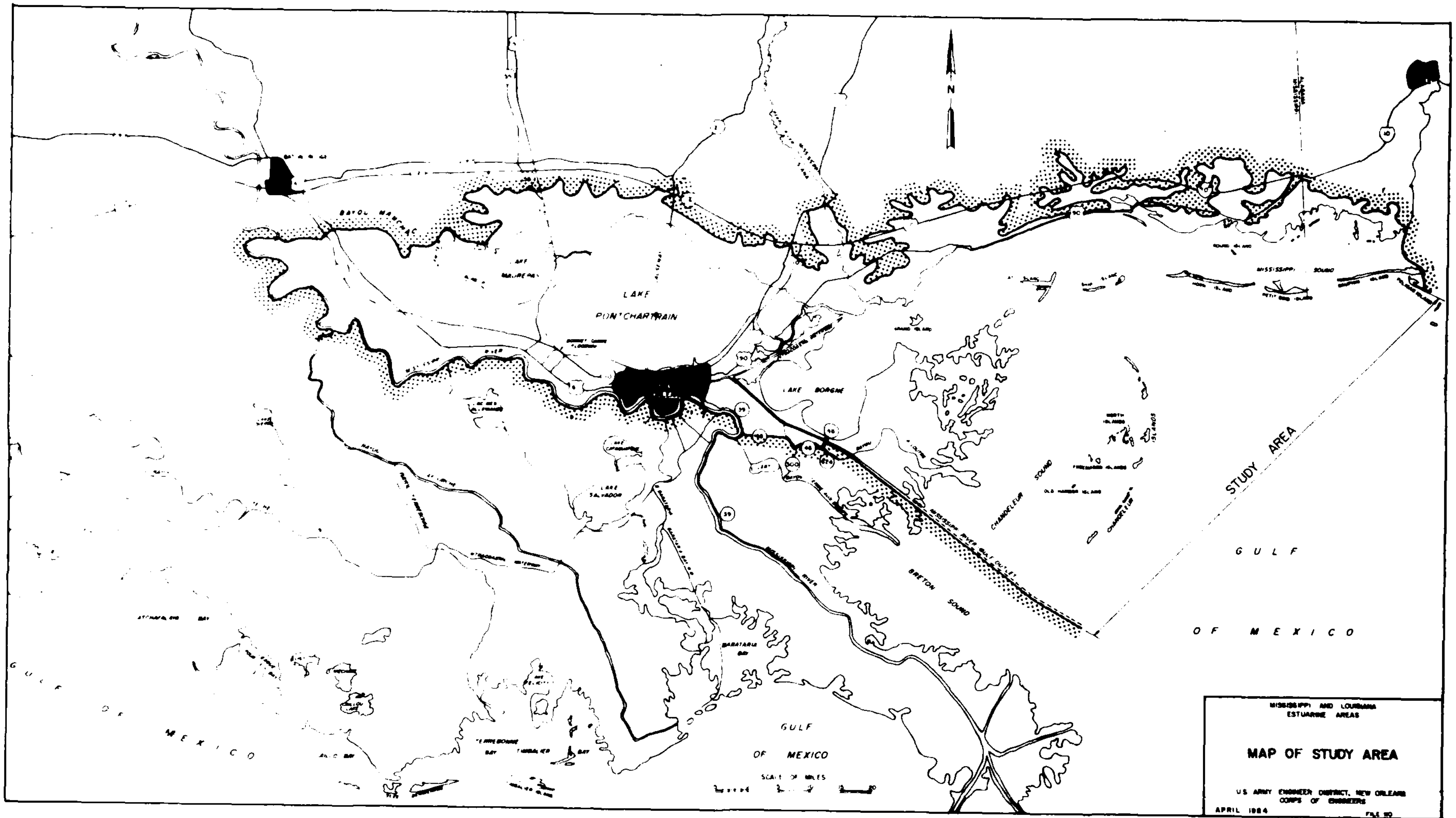
18 Apr 84
Date

ROBERT C. LEE
Colonel, CE
District Engineer

4. LITERATURE CITED

U. S. Environmental Protection Agency. 1980. Water quality criteria documents; availability. Federal Register 45 (231): 793317-79379.

Saucier, R. T., C. C. Calhoun, Jr., R. M. Engler, T. R. Patin, and H. K. Smith. 1978. Executive overview and detailed summary, Tech. Rep. DS-78-22, U. S. Army Waterways Experiment Station, Vicksburg, Mississippi. 189 pp.



STUDY AREA
LAKE PONTCHARTRAIN
LAKE BORGNE
LAKE SALVADOR
CHANDELEUR SOUND
BRETON SOUND
MISSISSIPPI SOUND
BAYOU MANCHAC
BARATARIA BAY
TERREBONNE BAY
TIMBALIER BAY
ATCHAFALAYA BAY
GULF OF MEXICO
SCALE OF MILES
MISSISSIPPI AND LOUISIANA ESTUARINE AREAS
MAP OF STUDY AREA
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
APRIL 1984

PLATE I-1

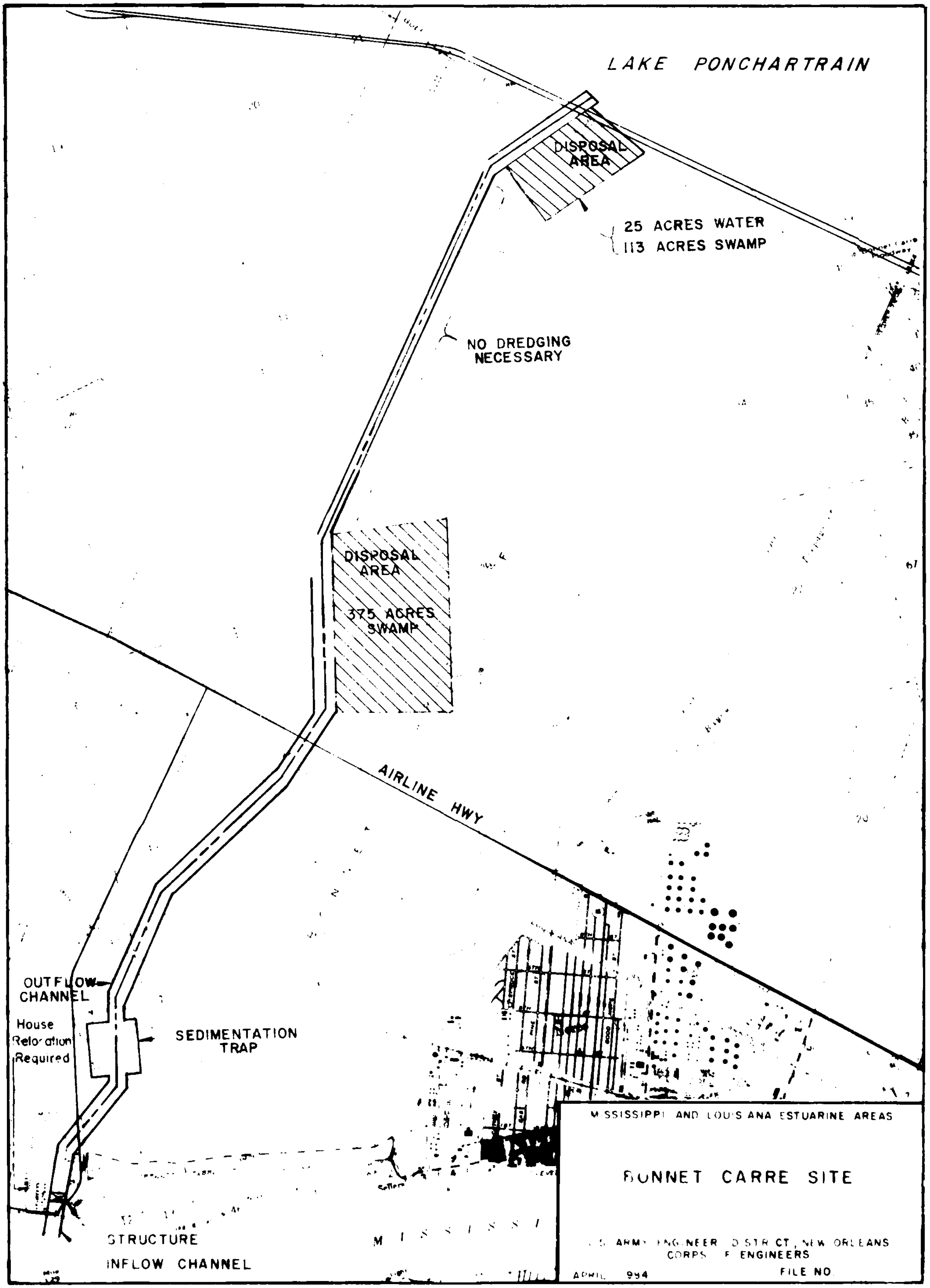
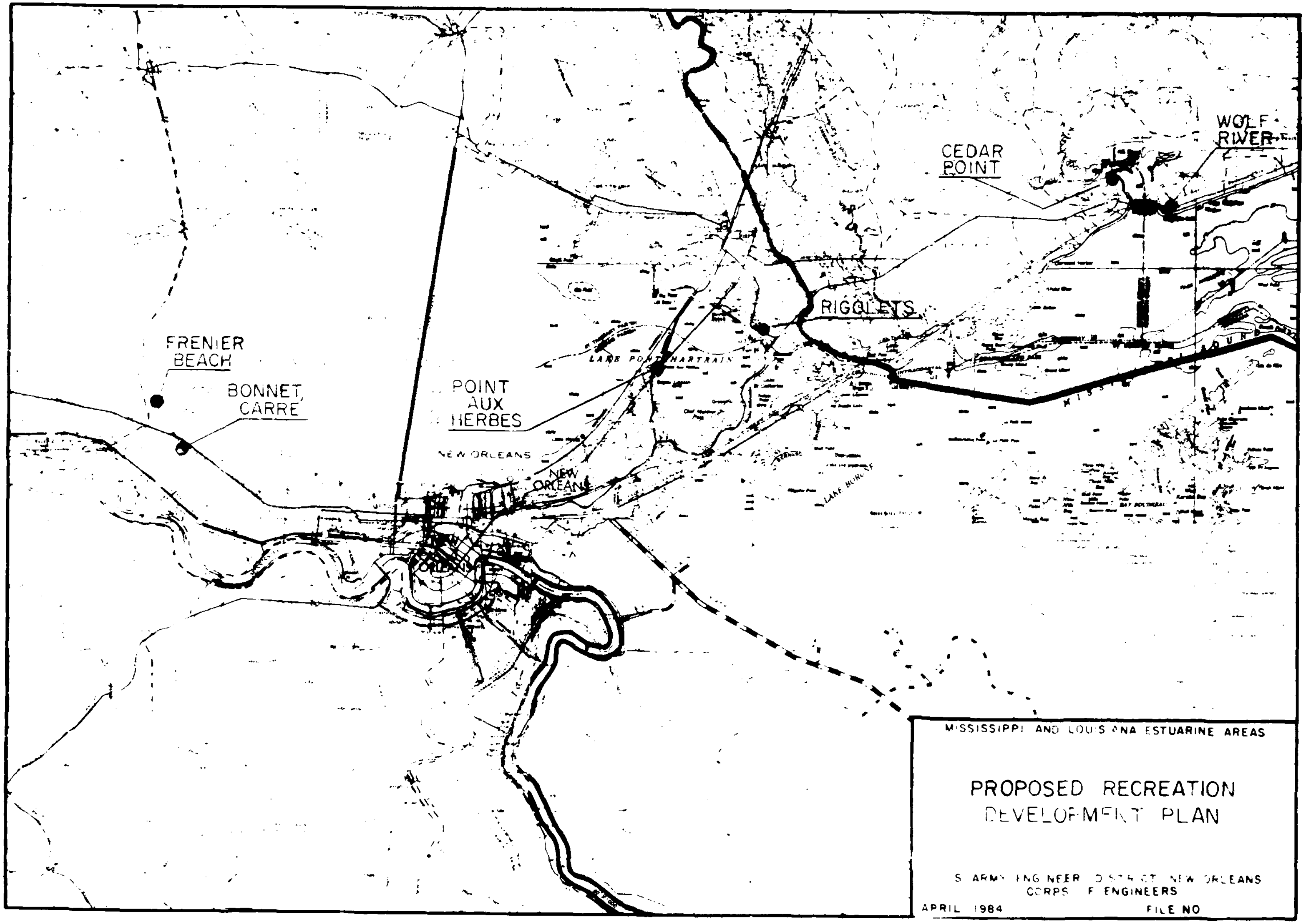

LAKE PONCHARTRAIN
DISPOSAL AREA
25 ACRES WATER
113 ACRES SWAMP
NO DREDGING NECESSARY
DISPOSAL AREA
375 ACRES SWAMP
AIRLINE HWY
OUTFLOW CHANNEL
House Relocation Required
SEDIMENTATION TRAP
STRUCTURE
INFLOW CHANNEL
MISSISSIPPI AND LOUISIANA ESTUARINE AREAS
BONNET CARRE SITE
CORPS ENGINEERS
FILE NO.

PLATE I - 2



MISSISSIPPI AND LOUISIANA ESTUARINE AREAS

PROPOSED RECREATION DEVELOPMENT PLAN

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

APRIL 1984 FILE NO

PLATE I-3

APPENDIX J

CONSISTENCY DETERMINATION
LOUISIANA COASTAL ZONE MANAGEMENT PROGRAM

MISSISSIPPI AND LOUISIANA ESTUARINE AREAS STUDY

Report on Freshwater Diversion

to the

Lake Pontchartrain Basin and Mississippi Sound

Appendix J

C O N S I S T E N C Y   D E T E R M I N A T I O N

LOUISIANA COASTAL ZONE MANAGEMENT PROGRAM

J.0.1. Section 307 of the Coastal Zone Management Act of 1972, 16 U.S.C. 1451 et. seq. requires that "each Federal agency conducting or supporting activities directly affecting the coastal zone shall conduct or support those activities in a manner which is, to the maximum extent practicable, consistent with approved state management programs." In accordance with Section 307, a consistency determination has been made for the Mississippi and Louisiana Estuarine Areas Study. Coastal Use Guidelines were written in order to implement the policies and goals of the Louisiana Coastal Resources Program, and serve as a set of performance standards for evaluating projects. Compliance with the Louisiana Coastal Resources Program, and therefore, Section 307, requires compliance with applicable Coastal Use Guidelines. An evaluation of the project relative to each guideline is presented in Section 1. A determination of the consistency of the project with the guidelines is in Section 2.

PROJECT DESCRIPTION

The Mississippi and Louisiana Estuarine Areas Study was authorized to investigate problems, needs and opportunities for improving fish and wildlife resources in and adjacent to Lakes Maurepas, Pontchartrain and Borgne, and Chandeleur and Mississippi Sounds. The Bonnet Carre' site would divert fresh water via a 6.4-mile channel from the Mississippi River into Lake Pontchartrain. The project would restore favorable salinity regimes in the study area. Benefits of the project would be decreased wetland deterioration, increased wetland productivity, and increased productivity of fish and wildlife resources, particularly the American oyster. Potential adverse impacts include the introduction of pollutants and cooler water, and loss of 618 acres of wooded swamp to construct the project.

Section 1. GUIDELINES

1. Guidelines Applicable to All Uses

Guideline 1.1: The guidelines must be read in their entirety. Any proposed use may be subject to the requirements of more than one guideline or section of guidelines and all applicable guidelines must be complied with.

Response 1.1: Acknowledged.

Guideline 1.2: Conformance with applicable water and air quality laws, standards and regulations, and with those other laws, standards and regulations which have been incorporated into the coastal resources program shall be deemed in conformance with the program except to the extent that these guidelines would impose additional requirements.

Response 1.2: Acknowledged.

Response 1.2: Acknowledged.

Guideline 1.3: The guidelines include both general provisions applicable to all uses and specific provisions applicable only to certain types of uses. The general guidelines apply in all situations. The specific guidelines apply only to the situations they address. Specific general guidelines should be interpreted to be consistent with each other. In the event there is an inconsistency, the specific should prevail.

Response 1.3: Acknowledged.

Guideline 1.4: These guidelines are not intended to nor shall they be interpreted so as to result in an involuntary acquisition or taking of property.

Response 1.4: Acknowledged.

Guideline 1.5: No use or activity shall be carried out or conducted in such a manner as to constitute a violation of the terms of a grant or donation of any lands or waterbottoms to the state or any subdivision thereof. Revocations of such grants and donations shall be avoided.

Response 1.5: Acknowledged.

Guideline 1.6: Information regarding the following general factors shall be utilized by the permitting authority in evaluating whether the proposed use is in compliance with the guidelines.

Response 1.6: Acknowledged.

Guideline 1.7: It is the policy of the coastal resources program to avoid the following adverse impacts. To this end, all uses and activities shall be planned, sited, designed, constructed, operated and maintained to avoid to the maximum extent practicable significant:

a. reductions in the natural supply of sediment and nutrients to the coastal system by alterations of freshwater flow.

Response 1.7a: The Lake Pontchartrain Basin and Mississippi Sound estuarine complex, as well as the oyster reefs in Louisiana and Mississippi, are expected to benefit from increased nutrient input resulting from the project.

b. adverse economic impacts on the locality of the use and affected governmental bodies.

Response 1.7b: Freshwater introduction into the study area would shift existing salinity regimes further seaward. As a result, some private oyster leases in Lake Borgne would become too fresh and production would be reduced or eliminated in these areas. There are about 19,000 acres privately leased in Lake Borgne. Of this, up to 7,000 acres could be adversely affected. However, average annual oyster benefits would far outweigh these losses. Nonetheless, the individual leaseholders in the affected areas would lose income from those areas. In addition, shrimp fishermen in Lake Pontchartrain may have to venture further seaward to catch brown shrimp during periods of diversions. Except for the above, no other serious adverse economic impacts are anticipated.

(c.) detrimental discharges of inorganic nutrient compounds into coastal waters.

Response 1.7c: Minimal quantities of nutrients would be released during the construction of channels by bucket dredging or later leached from the castings. Inorganic nutrient compounds would enter the Lake Pontchartrain - Borgne Estuarine complex with the Mississippi River

water during periods of diversion. Two macronutrients, un-ionized ammonia and phosphate, are of particular concern because of the present high levels in the river water. Un-ionized ammonia, which is toxic to aquatic animals, exceeded the EPA criterion (20 ug/l) in 24 percent of the samples. Phosphate, a nutrient that results in eutrophication, exceeded the EPA criterion (50 ug/l) in 92 percent of the samples. The introduction of enriching nutrients into Lake Pontchartrain could foster more unfavorable conditions than presently exist, especially during warm summer months.

(d) alterations in the natural concentrations of oxygen in coastal waters.

Response 1.7d: During construction, a very localized and temporary reduction in dissolved oxygen (DO) would occur in the immediate area of the inflow and outflow channel dredging. The DO concentrations of the Mississippi River are normally above that necessary to maintain aquatic populations. It is anticipated the introduction of river water would not adversely affect, and in some instances would help, the oxygen concentrations in Lake Pontchartrain.

(e) destruction or adverse alterations of streams, wetland, tidal passes, inshore waters and waterbottoms, beaches, dunes, barrier islands, and other natural biologically valuable areas or protective coastal features.

Response 1.7e: Of the 1,811 acres required to construct the diversion channel and associated structures, 618 acres are wetlands (wooded swamp) located within the spillway. In addition to the 618 acres of wooded swamps, approximately 63 acres of open water (lake bottoms) would be disturbed or impacted by bucket dredging and associated structure

the channel and the presence of the structure, which could be closed during major storm events, inland movement of storm surges would not be a significant problem.

Guideline 3.11: All nonnavigation canals, channels and ditches which connect more saline areas with fresher areas shall be plugged at all waterway crossings and at intervals between crossings in order to compartmentalize them. The plugs shall be properly maintained.

Response 3.11: The diversion structure itself would effectively serve as a plug.

Guideline 3.12: The multiple use of existing canals, directional drilling and other practical techniques shall be utilized to the maximum extent practicable to minimize the number and size of access canals, to minimize changes of natural systems and to minimize adverse impacts on natural areas and wildlife and fisheries habitat.

Response 3.12: The most practicable techniques would be used, and any changes in hydrologic regimes would be for the benefit of natural areas, wildlife, ard fisheries.

Guideline 3.13: All pipelines shall be constructed in accordance with parts 191, 192, and 195 of Title 49 of the Code of Federal Regulations, as amended, and in conformance with the Commissioner of Conservation's Pipeline Safety Rules and Regulations, and those safety requirements established by LA. R.S. 45:408, whichever would require higher standards.

other natural gulf shoreline must be traversed for a nonnavigation canal, they shall be restored at least to their natural condition immediately upon completion of construction. Tidal passes shall not be permanently widened or deepened except when necessary to conduct the use. The best available restoration techniques which improve the traversed area's ability to serve as a shoreline shall be used.

Response 3.8: Not applicable.

Guideline 3.9: Linear facilities shall be planned, designed, located and built using the best practical techniques to minimize disruption of natural hydrologic and sediment transport patterns, sheet flow, and water quality, and to minimize adverse impacts on wetlands.

Response 3.9: The diversion channels would minimally impact hydrologic and sediment regimes. The project operation is designed to modify the present regimes, and would improve wetland conditions.

Guideline 3.10: Linear facilities shall be planned, designed, and built using the best practical techniques to prevent bank slumping and erosion, saltwater intrusion, and to minimize the potential for inland movement of storm-generated surges. Consideration shall be given to the use of locks in navigation canals and channels which connect more saline areas with fresher areas.

Response 3.10: The diversion channels have been designed to minimize bank slumping and erosion in order to reduce maintenance dredging. In addition, existing borrow sites within the Bonnet Carre' Spillway rights-of-way would be utilized to the maximum extent practicable. These would be more stable than newly-dredged channels. The diversion of fresh water would restore historical salinities. Due to the large size of

Guideline 3.4: To the maximum extent practicable, pipelines shall be installed through the "push ditch" method and the ditch backfilled.

Response 3.4: Not applicable.

Guideline 3.5: Existing corridors, rights-of-way, canals, and streams shall be utilized to the maximum extent practicable for linear facilities.

Response 3.5: This diversion site utilizes existing rights-of-way in the Bonnet Carre' Spillway to the maximum extent practicable. Existing borrow pits are utilized for diversion channels to the greatest extent practicable.

Guideline 3.6: Linear facilities and alinements shall be, to the maximum extent practicable, designed and constructed to permit multiple uses consistent with the nature of the facility.

Response 3.6: At the present time, no other uses are planned for the diversion structures or channels.

Guideline 3.7: Linear facilities involving dredging shall not traverse or adversely affect any barrier island.

Response 3.7: Not applicable.

Guideline 3.8: Linear facilities involving dredging shall not traverse beaches, tidal passes, protective reefs or other natural gulf shoreline unless no other alternative exists. If a beach, tidal pass, reef or

Response 2.6: Not applicable. See Response 2.4.

3. Guidelines for Linear Facilities

Guideline 3.1: Linear use alinements shall be planned to avoid adverse impacts on areas of high biological productivity or irreplaceable resource areas.

Response 3.1: Levee construction has been minimized as cited in response 2.1. Additionally, channelization has been minimized to the greatest extent practicable through utilization of previously existing borrow areas for diversion channel.

Guideline 3.2: Linear facilities involving the use of dredging or filing shall be avoided in wetland and estuarine areas to the maximum extent practicable.

Response 3.2: This guideline has been addressed in the above guideline 3.1.

Guideline 3.3: Linear facilities involving dredging shall be of the minimum practical size and length.

Response 3.3: The channels would be constructed to the minimum size necessary to conduct the desired flow.

Guideline 2.3: Levees constructed for the purpose of developing or otherwise changing the use of a wetland area shall be avoided to the maximum extent practicable.

Response 2.3: Levees are not being constructed for any of the purposes stated above.

Guideline 2.4: Hurricane and flood protection levees shall be located at the non-wetland/wetland interface or landward to the maximum extent practicable.

Response 2.4: Levees constructed due to this project are designed only to prevent project-induced flooding, not to function as hurricane or flood protection levees.

Guideline 2.5: Impoundment levees shall only be constructed in wetland areas as part of approved marsh management projects or to prevent release of pollutants.

Response 2.5: No impoundment levees would be constructed in association with the proposed project.

Guideline 2.6: Hurricane or flood prevention levee systems shall be designed, built and thereafter operated and maintained utilizing best practical techniques to minimize disruptions of existing hydrologic patterns, and the interchange of water, beneficial nutrients, and aquatic organisms between enclosed wetlands and those outside the levee system.

Guideline 1.10: These guidelines are not intended to be, nor shall they be, interpreted to allow expansion of governmental authority beyond that established by LA R.S. 49:213.1 through 213.21, as amended; nor shall these guidelines be interpreted so as to require permits for specific uses legally commenced or established prior to the effective data of the coastal use permit program nor to normal maintenance or repair of such uses.

Response 1.10: Acknowledged.

2. Guidelines for Levees

Guideline 2.1. The leveeing of unmodified or biologically productive wetlands shall be avoided to the maximum extent practicable.

Response 2.1: The need for levee construction has been greatly reduced through utilization of the Bonnet Carre' Spillway alinement; therefore, leveeing of wetlands has been avoided to the maximum extent practicable.

Guideline 2.2: Levees shall be planned and sited to avoid segmentation of wetland areas to the maximum extent practicable.

Response 2.2: The small portions of levee needed to construct the project must be located as prescribed in order to implement the proposed project. No significant wetland segmentation would occur.

Guideline 1.8: In those guidelines in which the modifier "maximum extent practicable" is used, the proposed use is in compliance with the guideline if the standard modified by the term is complied with. If the modified standard is not complied with, the use will be in compliance with the guideline if the permitting authority finds, after a systematic consideration of all pertinent information regarding the use, the site and the impacts of the use as set forth in guideline 1.6, and a balancing of their relative significance, that the benefits resulting from the proposed use would clearly outweigh the adverse impacts resulting from noncompliance with the modified standard and there are no feasible and practicable alternative locations, methods and practices for the use that are in compliance with the modified standard and:

(a) significant public benefits will result from the use, or;

(b) the use would serve important regional, state or national interests, including the national interest in resources and the siting of facilities in the coastal zone identified in the coastal resources program, or;

(c) the use is coastal water dependent.

Response 1.8: Acknowledged.

Guideline 1.9: Uses shall to the maximum extent practicable be designed and carried out to permit multiple concurrent uses which are appropriate for the location and to avoid unnecessary conflicts with other uses in the vicinity.

Response 1.9: Acknowledged.

Response 1.7q: One playground located adjacent to the existing spillway levee would be destroyed. In conjunction with the project, additional recreational access is planned. Recreational hunting value of the marshes would be preserved due to the slight reduction in marsh loss attributable to the project.

(r) adverse disruptions of coastal wildlife and fishery migratory patterns.

Response 1.7r: The project would not adversely disrupt any wildlife or fishery migratory patterns. However, freshwater introduction could limit the extent of inland migration of some species into Lake Pontchartrain.

(s) land loss, erosion and subsidence.

Response 1.7s: The project is designed to help reduce land loss, erosion, and subsidence.

(t) increases in the potential for flood, hurricane or other storm damage, or increases in the likelihood that damage will occur from such hazards.

Response 1.7t: The project would not increase the flood, hurricane, or storm damage potential.

(u) reductions in the long-term biological productivity of the coastal ecosystem.

Response 1.7u: The project would increase long-term productivity through introduction of nutrients into the Lake Pontchartrain - Borgne Estuarine Complex, as well as slightly reduce the rate of wetland loss.

Corps regulations, any cultural resource determined eligible for inclusion into the National Register and determined to be adversely affected by the project would be either avoided, protected, or mitigated by data recovery.

(o) fostering of detrimental secondary impacts in undisturbed or biologically highly productive wetland areas.

Response 1.7o: Secondary effects of this project are related to changes in hydrologic regimes. Presently existing salinity regimes and therefore aquatic habitats would be shifted in response to the freshwater introduction. The shifts could result in temporary isolation of some aquatic species from normal spawning, nursery, and feeding areas. While most of these changes can be tolerated by the more mobile species, the benthic organisms could be adversely affected. The increased quantities of pesticides, heavy metals, and other industrial wastes might bioaccumulate and impact upper level animals in the food chain, especially predatory birds and mammals.

(p) adverse alteration or destruction of unique or valuable habitats, critical habitat for endangered species, important wildlife or fishery breeding or nursery areas, designated wildlife management or sanctuary areas, or forestlands.

Response 1.7p: The project would not adversely impact any such areas, and should improve the habitat value in many areas.

(q) adverse alteration or destruction of public parks, shoreline access points, public works, designated recreation areas, scenic rivers, or other areas of public use and concern.

and immediate receiving areas. Concentration of suspended and dissolved fractions would become progressively less with distance from the river due to dilution.

Agricultural chemicals, particularly the chlorinated pesticides, are frequently detected in the river; however, data indicate decreasing trends in EPA ambient water critieria exceedance for the persistant chlorinated pesticides - DDT, endrin, and dieldrin. Because the production and use of these compounds has been banned or severely restricted, introduction of significant quantities to the estuarine areas is unlikely. However, the potential effects of long-term exposure of bioaccumulator organisms to trace quantities are not known.

Available data on the range of concentrations and frequency of occurrence of volatile and semivolatile organics in the river are sparse; consequently, no firm conclusions can be drawn from their examination. Trichloromethane (chloroform) has been detected in the river at concentrations ranging from 1 to 90 ug/l and bromodichloromethane has been detected at concentrations up to 20 ug/l. Although the potential for a significant introduction of organics into estuarine areas exists, the volatility of these reduces the probability of serious impacts.

(n) adverse alteration or destruction of archeological, historical, or other cultural resources.

Response 1.7n: No cultural resources or National Register properties are presently recorded within the direct construction rights-of-way of the recommended plan. However, a cultural resources survey of the study area has not yet been completed. Upon completion of the cultural resources survey, results will be coordinated with the Louisiana State Historic Preservation Officer. In accordance with Federal law and

to the maintenance of aquatic life, while restricting the extent and duration of the excursions over that average to levels which would not cause harm. The maximum value, which is derived from acute toxicity data, is intended to prevent significant risk of adverse impacts to organisms exposed to concentration above the 24-hour average.

Comparison of measured concentrations of selected trace metals in the Mississippi River with EPA aquatic life saltwater criteria implies potentially significant problems due to recurrently high concentrations of copper, zinc, mercury, nickel, and cadmium. Data covering a 9-year period of record indicate that 27 percent of 254 samples collected had copper concentrations in excess of the EPA criterion not to be exceeded at any time. Ninety-six percent of these samples had copper concentrations which exceeded the EPA 24-hour average criterion. Eight percent of 265 samples collected over an 8-year period had concentrations of zinc which exceeded the EPA maximum saltwater criterion for the protection of aquatic life. However, 62 percent of those samples had mercury concentrations which exceeded the EPA 24-hour average criterion. None of the 152 samples collected between 1975 and 1980 had nickel concentrations in excess of the EPA maximum criterion; however, 56 percent of those samples had nickel concentrations that exceeded the 24-hour average criterion. Similarly, none of the 340 samples collected from 1973 through 1980 had cadmium concentrations in excess of the EPA maximum saltwater criterion, but 16 percent of those samples had cadmium concentrations which exceeded the 24-hour average criterion.

Comparison of criterion exceedance in the prospective receiving areas to that of the river indicates comparable percentage exceedances for copper, but significantly higher exceedance ratios for nickel, mercury, zinc, and cadmium in the river. Portions of the metals and other toxic substances would settle out with sediment particles in the sediment trap

(l) reductions or blockage of water flow or natural circulation patterns within or into an estuarine system or a wetland forest.

Response 1.7l: As designed, the input of Mississippi River water into the Lake Pontchartrain Basin and Mississippi Sound would shift the isohalines seaward during the period of diversion. Natural circulation, especially tidal flow, would still occur, but the water would be of a reduced salinity.

(m) *discharges of pathogens or toxic substances into coastal waters.*

Response 1.7m: The waters diverted from the Mississippi River could contain high quantities of pathogens. Fecal coliform densities in the river are high. The observed median of 506 organisms/100 ml in the river far exceeds the state standard for shellfish harvesting of 14 organisms/100 ml. As the introduced water flows into Lake Pontchartrain, natural die-off, dilution, sedimentation, and the bacteriocidal effect of increasing salinities would reduce fecal coliform densities before reaching shellfish harvesting areas. It appears that there would be no increased risk of disease due to consumption of raw or partially cooked shellfish. Because there would be extensive monitoring of the Mississippi River and receiving areas, flow could be reduced from the control structure or certain shellfishing areas closed if deemed necessary.

The EPA criteria specify pollutant concentrations which, if not exceeded, should protect most, but not necessarily all, aquatic life. These criteria specify both maximum and 24-hour average values. The two-number criterion is intended to describe the highest average ambient water concentration which would produce a water quality generally suited

(h) detrimental changes in existing salinity regimes.

Response 1.7h: The project is designed to restore favorable salinities in the Lake Pontchartrain - Borgne Estuarine Complex and Chandeleur and Mississippi Sound. It is expected that reestablishing these salinity regimes would be extremely beneficial to estuarine organisms, particularly the American oyster.

(i) detrimental changes in littoral and sediment transport processes.

Response 1.7i: The introduction of fresh water would have a minimal impact on the littoral and sediment transport process.

(j) adverse effects of cumulative impacts.

Response 1.7j: The adverse cumulative impacts of the project would be negligible.

(k) detrimental discharges of suspended solids into coastal waters, including turbidity resulting from dredging.

Response 1.7k: Bottom disturbance and effluent from dredging would contain minimal quantities of suspended solids, and would be of a short-term duration during project construction. Project operation would result in the discharge of suspended solids from the Mississippi River into the Lake Pontchartrain - Borgne Estuarine Complex. It appears that insufficient sediment would be transported to promote marsh building. The amount of suspended sediment entering the receiving waters of Lake Pontchartrain would be greatly reduced as a result of the sediment trap feature included in the proposed project.

placement. Wetland impacts have been minimized to the maximum extent possible by confining diversion channels to existing borrow pits and spillway right-of-way.

(f) adverse disruption of existing social patterns.

Response 1.7f: The Bonnet Carre' plan would cause adverse social impacts resulting largely from relocation requirements, additional noise during construction, and relocation of some important marine fishery species such as brown shrimp, spotted sea trout, and red drum in Lake Pontchartrain, particularly during diversion periods. An estimated 69 structures between the spillway and the Little Gypsy Electric Generating Station would require relocation.

(g) alterations of the natural temperature regime of coastal waters.

Response 1.7g: Increased turbidity would result in slightly raised water temperatures near the diversion channels during construction. The effect would be very local and temporary, because most of the sediment would fall out or be captured in the cast and stacked material. Diversions would occur from March through November, with varying magnitudes of flow. The temperature differential between the river and Lake Pontchartrain varies depending on the month of the year. The most significant temperature differences would occur from March through May when the difference in river and lake temperatures might average 6° to 10°C. It is anticipated that any adverse impacts due to these temperature differences would be experienced primarily adjacent to the diversion outfall.

Response 3.13: Not applicable.

Guideline 3.14: Areas dredged for linear facilities shall be backfilled or otherwise restored to the pre-existing conditions upon cessation of use for navigation purposes to the maximum extent practicable.

Response 3.14: Not applicable.

Guideline 3.15: The best practical techniques for site restoration and revegetation shall be utilized for all linear facilities.

Response 3.15: Not applicable.

Guideline 3.16: Confined and dead end canals shall be avoided to the maximum extent practicable. Approved canals must be designed and constructed using the best practical techniques to avoid water stagnation and eutrophication.

Response 3.16: Not applicable.

4. Guidelines for Dredged Spoil Deposition

Guideline 4.1: Spoil shall be deposited utilizing the best practical techniques to avoid disruption of water movement, flow, circulation and quality.

Response 4.1: Dredging and associated dredged material deposition has been minimized to the greatest extent practicable as noted in responses 2.1 and 3.1. Placement of dredged material would be temporary and done in such a way so as not to interfere with water flow or movement. It is

proposed that material produced from structure placement and connecting channel construction be utilized in the guide levee realinement.

Guideline 4.2: Spoil should be used beneficially to the maximum extent practicable to improve productivity or create new habitat, reduce or compensate for environmental damage done by dredging activities, or prevent environmental damage. Otherwise, existing spoil disposal areas or upland disposal shall be utilized to the maximum extent practicable rather than creating new disposal areas.

Response 4.2: Material from the channels would be used as noted in response 4.1. Environmental damages would be reduced to the maximum extent practicable.

Guideline 4.3: Spoil shall not be disposed of in a manner which could result in the impounding or draining of wetlands or the creation of development sites unless the spoil deposition is part of an approved levee or land surface alteration project.

Response 4.3: Dredged material would not be used for impounding or draining wetlands. Some material would be removed by sand haulers to be utilized in adjacent developed areas outside of the spillway.

Guideline 4.4: Spoil shall not be disposed of on marsh, known oyster or clam reefs or in areas of submersed vegetation to the maximum extent practicable.

Response 4.4: Dredged material would not be placed on any of the above.

Guideline 4.5: Spoil shall not be disposed of in such a manner as to create a hindrance to navigation or fishing, or hinder timber growth.

Response 4.5: Dredged material would not create a hindrance to navigation, fishing, or timber growth.

Guideline 4.6: Spoil disposal areas shall be designed and constructed and maintained using the best practical techniques to retain the spoil at the site, reduce turbidity, and reduce shoreline erosion when appropriate.

Response 4.6: Because material would be moved quickly from the disposal site and utilized as noted in response 4.1, it is not expected that erosion and turbidity would be a long-term impact.

Guideline 4.7: The alienation of state-owned property shall not result from spoil deposition activities without the consent of the Department of Natural Resources.

Response 4.7: No state-owned property would be alienated.

5. Guidelines for Shoreline Modifications

Not applicable.

6. Guidelines for Surface Modifications

Not applicable.

7. Guidelines for Hydrologic and Sediment Transport Modifications

Guideline 7.1: The controlled diversion of sediment-laden water to initiate new cycles of marsh building and sediment nourishment shall be encouraged and utilized whenever such diversion will enhance the viability and productivity of the outfall area. Such diversions shall incorporate a plan for monitoring and reduction and/or amelioration of the effects of pollutants present in the freshwater source.

Response 7.1: Suspended sediment concentrations in the Mississippi River are variable, depending on flow. During the diversion season (March - November), under project design conditions, the suspended sediment in the river at the point of diversion would range from about 30 to 440 mg/l and would average approximately 330 mg/l. The sand fraction of the suspended material being diverted is expected to be approximately 30 percent and would be deposited into the sediment trap. Assuming these concentrations, it is predicted that approximately 2.1 million tons of suspended silt and clay would be diverted during a typical diversion season. A minor portion of this amount would be deposited into the conveyance channel.

Because of the potential for introducing pollutants from the Mississippi River, a water quality sampling program is a vital component of the project. The sampling program, which would involve water, sediment, and tissue samples, would consist of three stages: the first would be 3 years of pre-diversion data to supplement the current data base; the second would consist of an intensive study during the first 4 years after diversion; and the third stage would be a permanent program based on the needs determined by the second stage. Sample sites would include the diversion structures and selected sites in Lake Pontchartrain and other receiving areas.

Guideline 7.2: Sediment deposition systems may be used to offset land loss, to create or restore wetland areas or enhance building characteristics of a development site. Such systems shall only be utilized as part of an approved plan. Sediment from these systems shall only be discharged in the area that the proposed use is to be accomplished.

Response 7.2: See Response 7.1.

Guideline 7.3: Undesirable deposition of sediments in sensitive habitat or navigation areas shall be avoided through the use of the best preventive techniques.

Response 7.3: Deposited sediments should not impact any sensitive habitat or navigational areas. The sediment trap incorporated in the project design should minimize sediment discharge into the receiving waters of Lake Pontchartrain. It is not expected that maintainance dredging would be necessary to maintain design flow in the channel. Localized deposition should be minimized in the outflow channel by the sedimentation trap feature. Periodic maintenance dredging of the sediment trap would be necessary.

Guideline 7.4: The diversion of freshwater through siphons and controlled conduits and channels, and overland flow to offset saltwater intrusion and to introduce nutrients into wetlands shall be encouraged and utilized whenever such diversion will enhance the viability and productivity of the outfall area. Such diversions shall incorporate a plan for monitoring and reduction and/or amelioration of the effects of pollutants present in the freshwater source.

Response 7.4: The purpose of the project is to introduce fresh water and nutrients to ameliorate saltwater intrusion which has occurred in the area. A monitoring program would be conducted to analyze the water, sediment, and fish and wildlife tissue quality as was addressed in guideline 7.1.

Guideline 7.5: Water or marsh management plans shall result in an overall benefit to the productivity of the area.

Response 7.5: The project would result in increased productivity through nutrient introduction and the creation of optimum salinities for fish and wildlife production. Approximately 4,200 acres of marsh and 6,400 acres of wooded swamp would be saved by the diversion over the project life.

Guideline 7.6: Water control structures shall be assessed separately based on their individual merits and impacts and in relation to their overall water or marsh management plan of which they are a part.

Response 7.6: The diversion structure at the Bonnet Carre' Spillway was assessed separately, and was found to be beneficial in adding nutrients and modifying the salinity regime to provide conditions more conducive to fish and wildlife production, particularly the American oyster.

Guideline 7.7: Weirs and similar water control structures shall be designed and built using the best practical techniques to prevent "cut arounds," permit tidal exchange in tidal areas, and minimize obstruction of the migration of aquatic organisms.

Response 7.7: The control structures would be designed with the best techniques available, and would not impact the migration of aquatic organisms. Tidal exchange would still occur, but the salinities of the water would be reduced.

Guideline 7.8: Impoundments which prevent normal tidal exchange and/or the migration of aquatic organisms shall not be constructed in brackish and saline areas to the maximum extent practicable.

Response 7.8: Not applicable.

Guideline 7.9: Withdrawal of surface and ground water shall not result in saltwater intrusion or land subsidence to the maximum extent practicable.

Response 7.9: Not applicable.

8. Guidelines for Disposal of Wastes

Not applicable.

9. Guidelines for Uses that Result in the Alteration of Waters Draining into Coastal Waters

Not applicable.

10. Guidelines for Oil, Gas, and Other Mineral Activities

Not applicable.

Section 2. CONSISTENCY DETERMINATION

Based on this evaluation, the New Orleans District of the US Army Corps of Engineers has determined that implementation of the proposed plan for freshwater diversion to the Lake Pontchartrain Basin and Mississippi Sound is consistent, to the maximum extent practicable, with the State of Louisiana's approved Coastal Zone Management Program.

APPENDIX K

FRESHWATER DIVERSION STRUCTURE
OPERATION CRITERIA

AND

COMPREHENSIVE MONITORING SYSTEM

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Appendix K

FRESHWATER DIVERSION STRUCTURE OPERATION CRITERIA AND COMPREHENSIVE MONITORING SYSTEM

K.0.1. This appendix contains information on the operation criteria and monitoring system required for operating the Bonnet Carre' freshwater diversion structure. Section 1 of the appendix is a synopsis of the operation criteria for freshwater diversion. Section 2 is a discussion of the recommended operating scheme for freshwater diversion structures. Section 3 is a description of the planned monitoring system.

Section 1. GENERAL OVERVIEW OF OPERATIONAL CRITERIA

K.1.1. Although operation of the project will be a non-Federal responsibility, the Corps of Engineers will take a leadership role in implementing the comprehensive monitoring system. As part of the operation of the project, the Corps of Engineers and the non-Federal sponsors will be required to establish a two-state interagency advisory group to participate in governing structure operation. This group should include local, parish, state, and Federal people who have expert knowledge of the multiple needs of fish and wildlife resources, water quality and supply, navigation, and flood control. In addition, people would be included in the group to represent sport and commercial fish and wildlife interest. The sponsor must also maintain a comprehensive monitoring system to collect hydrological, water quality, and biological data essential for determining the best use of diverted water. The design and conduct of the long term monitoring system will be determined by the New Orleans District with the cooperation of the advisory group after the postconstruction monitoring phase is completed. The sponsor will provide timely reports containing collected data and analysis of structure operation and results to the New Orleans District. The district will review the reports to determine whether the structure operation manual should be modified to obtain maximum benefits.

K.1.2. Establishing workable operational criteria is a key element in the success of any freshwater diversion structure. Because operating conditions will vary from year to year, a flexible plan will be required to operate the structure on a month-to-month basis. Thus, it is premature to establish specific opertional plans at this time.

K.1.3. Maintaining the optimal salinity regime in the St. Bernard marshes should be the goal in the Lake Pontchartrain Basin and Mississippi Sound. Therefore, the key parameter governing operation of

the structures would be salinity. However, water quality as well as biological information such as impacts of cooler river water on juveniles of certain estuarine-dependent organisms would play a role in structure operation. The timing and duration of the releases of fresh water must be closely coordinated with the migration of the juveniles into the estuaries. Water quality and biological monitoring programs of Federal, state, parish, and local monitoring systems could be used. However, these programs must be examined in detail and supplemented to provide required information. Sampling locations, frequencies, and parameters of existing programs may need to be modified and expanded. Operation of the project will not occur until several years in the future and conditions are constantly changing. Therefore, the monitoring programs should be designed in detail during advanced engineering and design studies.

Section 2. OPERATING SCHEME FOR FRESHWATER DIVERSION STRUCTURE

INTRODUCTION

K.2.1. Operation of a freshwater diversion structure would pose a complex water management problem. The complexity stems from two areas of uncertainty. First, predicting ambient conditions would be problematic since such predictions would involve long-range estimates of national, regional, and local weather. Second, the current ability to relate the quantities, dimensions, and time distribution of diversions to estuarine health and productivity is quite elementary. Therefore, operational procedures established at the outset must be considered as a point of departure from which successive refinements would emerge as experience grows.

OPERATING SCHEME

K.2.2. A comprehensive monitoring system would be established to provide water quality, biological, and hydrological data that the advisory group would use in determining the operating scheme for the freshwater diversion structure. The group would use water quality data to reduce the possibility of substances entering receiving areas in quantities that would adversely affect fish and wildlife. With the biological data, the group would identify fish and wildlife resource responses to the diverted freshwater. The group would use a linear regression model that expresses salinity as a function of freshwater inflows to the basin (Appendix C, Engineering Investigations) to forecast salinity and compute the required supplemental flows. The comprehensive monitoring system is discussed in detail in Section 3 of this appendix.

K.2.3. Each January, results of the previous year's operation and salinity and discharge data from the previous month could be used to project the basin water status before beginning the new year's operation. At mid-month, recently collected data (salinity, discharge, etc.) could be used to adjust releases to meet the predicted water need for the balance of the month. This boot-strap operation would continue through the year. Environmental data collection would continue all year to assess success of that year's operation.

K.2.4. Particular attention would be paid to months when heavy rainfall occurs in the Lake Pontchartrain and Pearl River basins. During these months, supplemental flows would be adjusted so that the area is not overfreshened by the supplemental flow. If rainfall heavy enough to overfreshen the area occurs during diversion, the structure would be closed.

K.2.5. When salinities are predicted to be greater than desired, supplemental flows would be diverted based on computations and refinements to the linear regression model. If salinities are predicted to be less than desired, supplemental flows would be decreased or halted. Refining the operation to determine the proper quantities of freshwater to be released and the appropriate timing of the release, and correctly interpreting the field and discharge data would come through actual operation, data collection, and analysis.

Section 3. COMPREHENSIVE MONITORING SYSTEM

INTRODUCTION

K.3.1. An intricate network of hydrological, water quality, and biological monitoring would be established as part of the freshwater diversion project. Existing data collection facilities would be used to the maximum extent practicable. The network monitoring system would be designed in detail for the freshwater diversion project during advanced engineering and design studies.

K.3.2. The network monitoring system would comprise three major elements: a water quality monitoring program, a biological monitoring program, and a hydrological monitoring program to assist in operating the control structure during the life of the project. Under the US Army Corps of Engineers auspices, an intensive water quality and biological monitoring program would be conducted for three years prior to construction of the project and in the four years in which the freshwater is diverted subsequent to construction. The purpose of the programs would be to determine and verify beneficial and adverse impacts of fresh water on water quality, estuarine habitats, and fish and wildlife resources. Water quality and biological data gathered three years prior to construction would be used to establish base conditions. Part of the preconstruction monitoring program would involve coordination with other Federal, state, parish, and local agencies to assimilate and analyze any existing information that has not yet been published or put in a readily retrievable form. Postconstruction monitoring would be of the same magnitude as the preconstruction monitoring in order to evaluate the effects of the diverted fresh water. Data collected from the preconstruction and postconstuction program would be analyzed to determine the extent and magnitude of water quality and biological monitoring required throughout the remaining 46 years of project life.

Estimated cost of the preconstruction and postconstruction monitoring program is $2,156,000 and $2,860,000, respectively. This cost is part of the first cost. The annual operating cost associated with the monitoring program is estimated at $243,000.

WATER QUALITY MONITORING PROGRAM

K.3.3. The water quality monitoring program would measure selected water quality parameters before freshwater diversion is initiated to supplement historical base condition data, and after diversion is initiated to assess changes in constituent concentrations. Sampling collection stations would include one station at the diversion structure and perhaps 19 stations throughout the basin. Existing sampling stations operated by Federal, state, and local agencies would be used to the fullest extent. Tentative sampling station locations are shown on plate K-1. Final sampling station selection would be made during advanced engineering and design studies.

K.3.4. The program would probably be initiated by sampling at sufficient strategic locations to define seasonal and climatic variations in water quality constituents. These data combined with presently available historical data would provide a base condition by which changes in water quality that result from freshwater diversion could be assessed. Tracer studies would be required to define existing surface water hydraulics in receiving areas. During the first four years of project operation, water quality data would be collected at the same locations. The data would be used to assess seasonal changes and trends in water and sediment quality that result from diverting fresh water. During this four-year freshwater diversion impact assessment, the data would be analyzed to identify any modifications required in the program determinants such as sampling station locations, frequency of

sampling, and constituents included in sample analyses. The program would be modified or improved at any time to achieve the desired objective. By the conclusion of the postconstruction monitoring program, the nature of the long term water quality monitoring program would be determined. If data collected in postconstruction indicates that adverse water quality impacts are negligible, the sampling program would be curtailed. Conversely, the data could indicate a need for maintaining or expanding the postconstruction program. Surface water constituents that would probably be monitored during the preconstruction and postconstruction phase are listed below:

Selected organic compounds in water and fish tissue
Total phosphates
Orthophosphates
DO
Temperature
Specific conductance
pH
Turbidity
COD
Fecal coliform bacteria
Total hardness
Total dissolved solids
Total suspended solids
Ammonia nitrogen
TKN
Chlorophyll a
Total manganese
Total chromium
Total cadmium
Total copper
Total mercury
Total nickel
Total lead
Total zinc
Aldrin
Dieldrin
DDT and metabolites
Endrin
Chlordane
Heptachlor
Toxaphene
Lindane

PCB
Priority Pollutants

Sediments would be analysed for the following:

Redox potential (Eh)
pH
Total solids
Total volatile solids (residue loss on ignition)
Oil and grease
Chemical oxygen demand
Total kjeldahl nitrogen
Mercury
Lead
Zinc
Chromium
Cadmium
Copper
Iron
Manganese
Nickel
Aldrin
Dieldrin
Chlordane
Endrin
Heptachlor
Lindane
DDT and metabolites
Toxaphene
PCB
Priority Pollutants

K.3.5. All data generated would be maintained in the EPA STORET system to provide easy access to many users. The data base thus created would be a complement to data generated from the EPA Mussel Watch Program and would be useful in indicating significant changes in the quality of Louisiana's coastal waters. The cost of the preconstruction and postconstruction water quality monitoring programs is estimated at $1,136,000 and $1,500,000, respectively. This cost is part of the first cost. The annual operating cost is about $92,000.

BIOLOGICAL MONITORING PROGRAM

K.3.6. The biological monitoring program would be established to determine the effects of the diverted fresh water on estuarine habitats and fish and wildlife resources. The program would be designed in detail during advanced engineering and design studies with close coordination with the appropriate Federal, state, parish, and local agencies interested in the fish and wildlife resources of the study area. Data would be collected on vegetation and fish and wildlife populations during the three-year preconstruction and four-year postconstruction program. Transects would be established to determine vegetation changes that occur as a result of diverting fresh water. Aerial photography would also be a useful tool in assessing marsh changes. These vegetation surveys would provide meaningful data on long term impacts of the proposed project. Seagrass beds in the study area would be monitored to assess project impacts. Pre- and postconstruction counts of alligators, muskrat houses, and waterfowl would be made. These data and harvest records would yield valuable information on wildlife productivity. The counts would be conducted in coordination with the Louisiana Department of Wildlife and Fisheries, which already has an ongoing program to collect such baseline data.

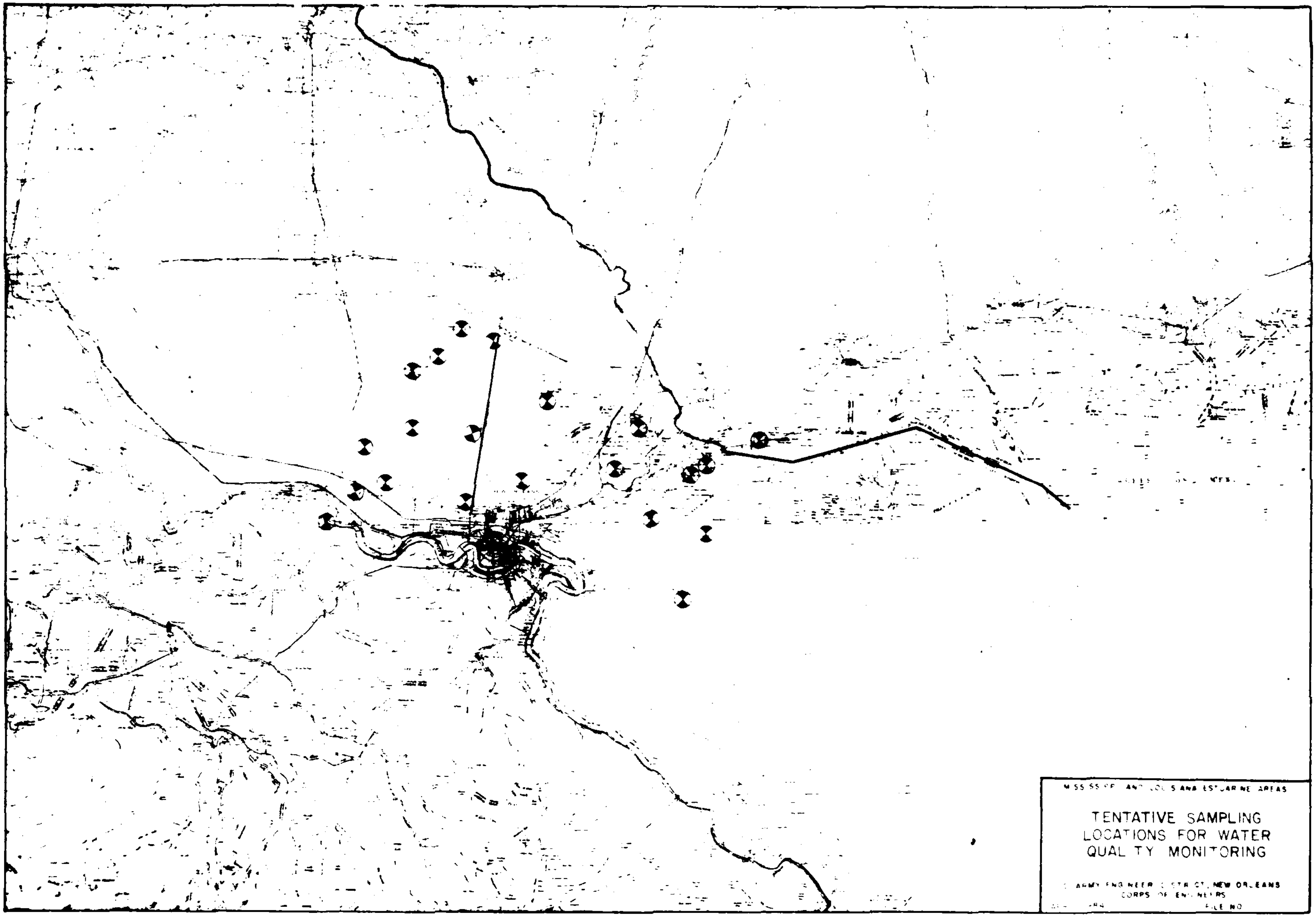
K.3.7. Commercially important shellfish and finfish populations that would be monitored include shrimp, oysters, crabs, menhaden, groundfish, and catfish. In addition, some resident and relatively nonmotile species would be monitored since their population levels and body burden of pollutants are rapidly responsive to changes in water quality. Some of the organisms collected would be subjected to tissue analyses to examine potential bioaccumulation of pollutants. Some tissue analysis of wildlife and vegetation would also be conducted. These analyses would be performed as part of the water quality monitoring program previously discussed.

K.3.8. Sampling would be conducted at selected stations throughout the study area. Data obtained from monitoring important juvenile species would be used in structure operation. The data would provide information on changes in species distribution, diversity, and abundance. Substantial efforts would be devoted to monitoring of brown shrimp as a result of considerable concern of the proposed project on Lake Pontchartrain's brown shrimp fishery. Extensive monitoring of oyster reefs would be required to determine spat setting success and overall productivity. Information concerning these sessile organisms would document project performance since most of the benefits attributable to the projects are associated with increased oyster harvests. Sampling equipment required for monitoring includes plankton nets, beam trawls, otter trawls, seines, gill nets, benthic samplers, and oyster dredges. Data gathered from the pre- and postconstruction monitoring program would be used to determine the magnitude and extent of the biological monitoring program for the remaining 46 years of project life. The cost of the preconstruction and postconstruction biological monitoring programs is estimated at $1,080,000 and $1,360,000, respectively. This cost is included in the first cost. The annual operating cost is about $28,000.

K.3.9. Extreme care must be exercised in developing the biological monitoring program to assure that data collected are meaningful and statistically valid. Personnel from the appropriate agencies involved in developing the program would include fisheries scientists and managers familiar with Louisiana fisheries. A statistical experience in design of field sampling programs would be an integral part of the team.

HYDROLOGICAL MONITORING PROGRAM

K.3.10. In addition to the water quality and biological monitoring program, a hydrological monitoring program would be established to assist in determining structure operation. The program would be in existence throughout the life of the project. Existing gaging stations in the study area would be used to the maximum extent practicable. No new permanent stations would be established. Extensive salinity monitoring would be conducted on a weekly basis and would consist of transects in Lakes Pontchartrain and Borgne, Biloxi marshes, and the western Mississippi Sound. Existing sampling and gaging station locations are shown in plate K-2. The annual operating cost associated with the hydrological monitoring program is $123,000.



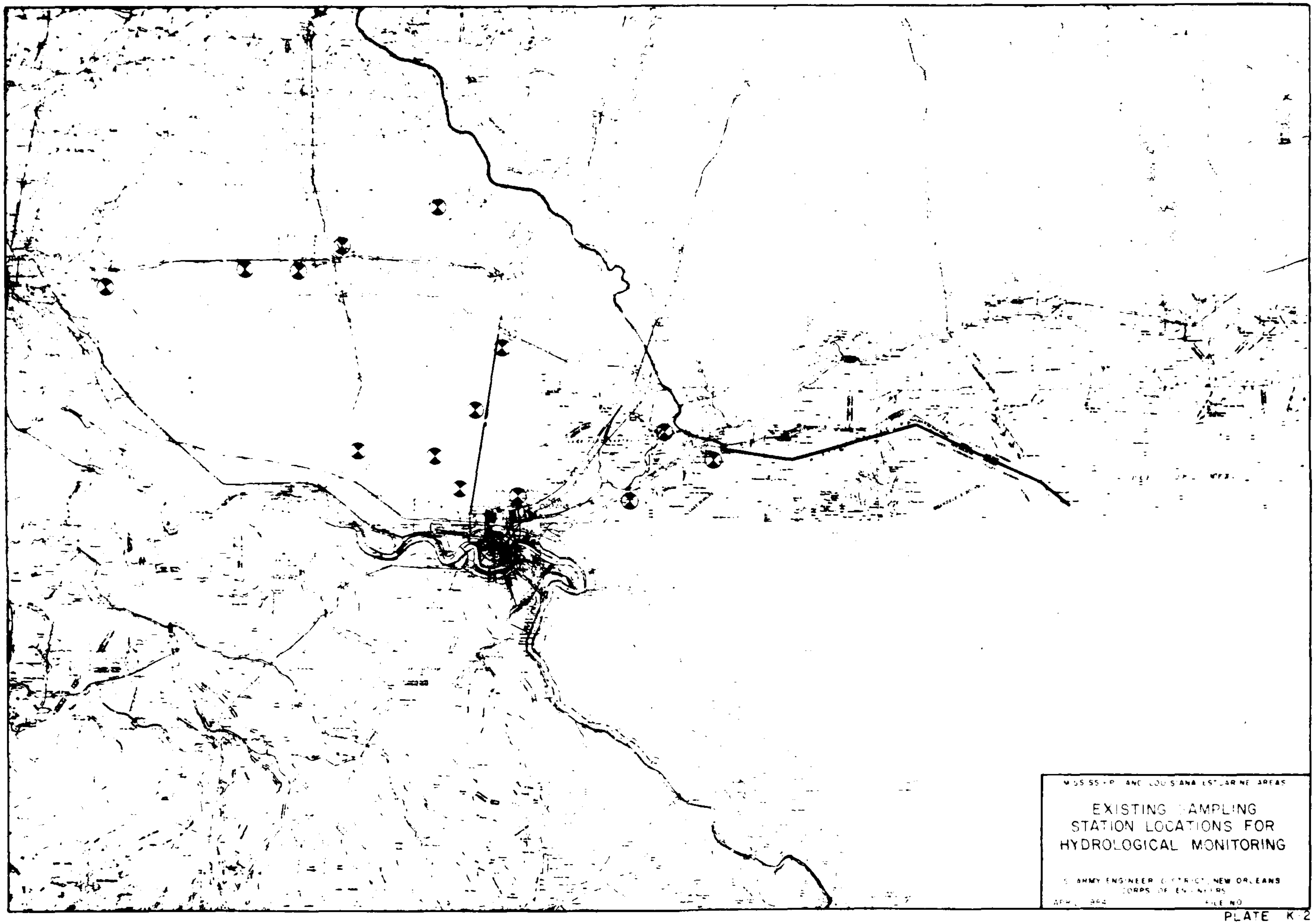
MISSISSIPPI AND LOUISIANA ESTUARINE AREAS

TENTATIVE SAMPLING LOCATIONS FOR WATER QUALITY MONITORING

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

FILE NO.

PLATE K-1



MISSISSIPPI AND LOUISIANA ESTUARINE AREAS

EXISTING SAMPLING STATION LOCATIONS FOR HYDROLOGICAL MONITORING

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

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PLATE K-2

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